POPULAR SCIENCE

MONTHLY

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SEE PAGE 37

NEW INVENTIONS · MECHANICS · MONEY MAKING IDEAS
HOME WORKSHOP PLANS AND HINTS · 350 PICTURES

SO LITTLE . . . SO LOVABLE

and so dependent on you

WHAT excitement there was when she got her first tooth. And her second! And now there are seven. Already she is making brave attempts to say a word or two.

Much of your life is given over to keeping her well and happy. For she is so little and lovable—and so dependent on you.

During the day and through the darkness of night you have a feeling of safety and security because of the telephone. It is an ever-watchful guardian of your home—ready to serve you in the ordinary affairs of life and in time of emergency.

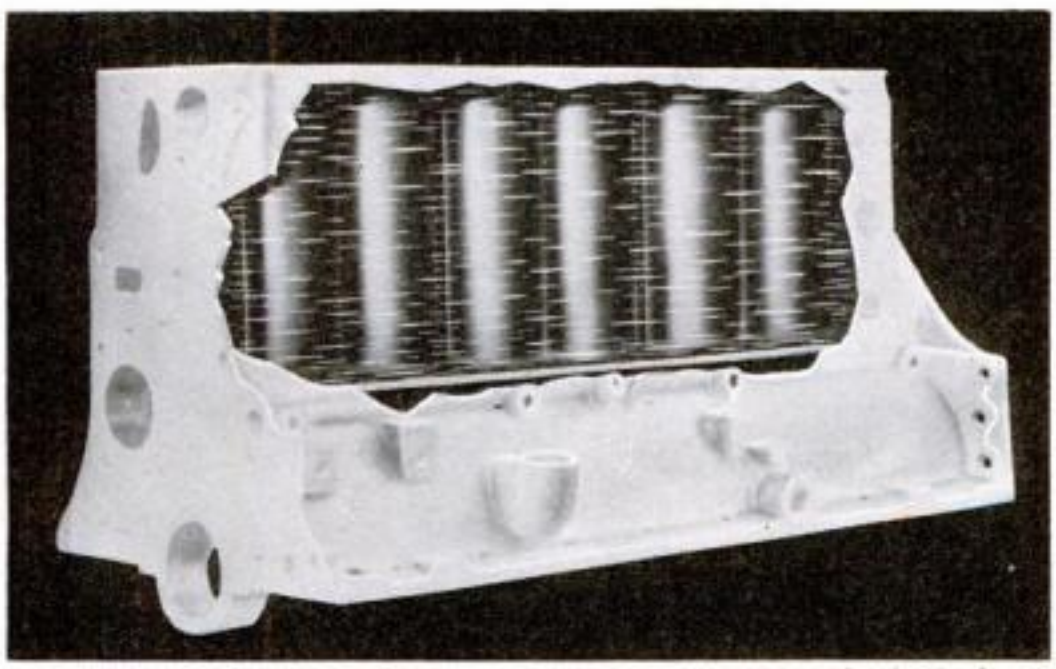
In office and store and factory and on the farm the telephone is an equally important part of every activity.

The telephone would not be what it is today if it were not for the nation-wide Bell System. Its unified plan of operation has developed telephone service to its present high efficiency and brought it within reach of people everywhere.

An extension telephone in your bedroom, sun room, kitchen or nursery will save many steps each day. It insures greater safety and privacy yet the monthly charge is small.

BELL TELEPHONE SYSTEM

HOW SCIENCE MAKES CARS LAST LONGER TODAY



COOLING ENTIRE CYLINDER . . . water jackets the full length of cylinders cool the whole area . . . reduce temperatures of engine oil as much as 50°.

Big New Plymouth a Supreme Example of Long Life at Low Price

WHEN YOU MASTER heat and vibration in an automobile, you have a car that will "stand up" . . . a car that will be dependable . . . a car that will last.

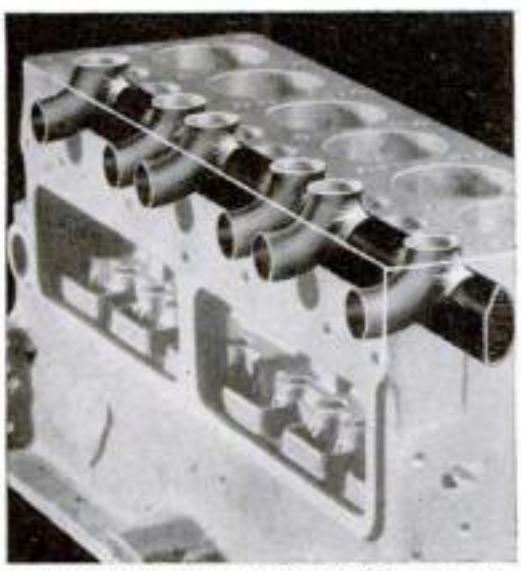
This is a brief story of such a car . . . the new Plymouth. Instead of beautiful pictures of the car, we show some of the ways Plymouth engineers have "whipped" heat and vibration.

Plymouth cylinders have full-length water jackets. They reduce oil temperatures as much as 50°. See how water is directed to cool the super-hot exhaust valve seats. Even the clutch is cooled by air . . . the generator, too. Destructive heat is everywhere reduced . . . parts last longer . . . the engine runs "sweeter."

Engine vibration is "absorbed" by Plymouth's famed Floating Power engine mountings. New springs and proper weight re-distribution lessen vibration throughout the whole car . . . lengthening car-life.

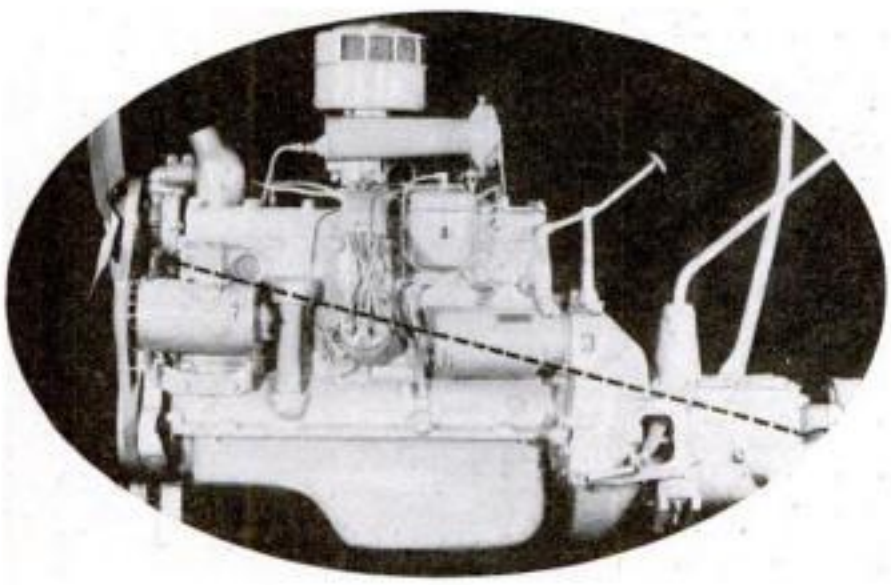
This is only a fraction of what you can find out by driving a new Plymouth. Ask any Dodge, De Soto or Chrysler dealer.

New Plymouth now only $510 and up, f.o.b. Factory, Detroit. Easy terms by the official Chrysler Motors Commercial Credit Plan.



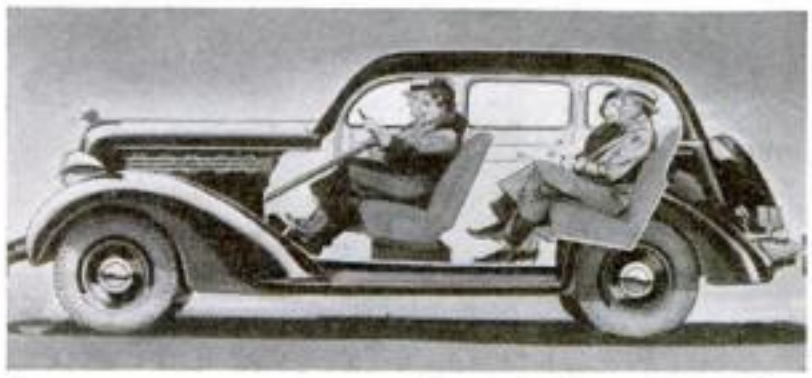
EXHAUST VALVE SEATS sprayed by high velocity cool-water jets.

VALVE SEAT INSERTS save owners up to $25 on valve-grinding costs.



FAMED FLOATING POWER engine mountings suspend the engine in balance but free to "rock"... dissipating vibration.

PLYMOUTH'S CORRECT RE-DISTRIBUTION OF WEIGHT — ENGINE AND SEATS MOVED FORWARD



BACK-SEAT RIDES as smoothly as the front. This is the principle that was introduced by the famous "Airflow" cars.

RAYMOND J. BROWN, *Editor*
ARTHUR WAKELING, *Home Workshop Editor*
ALDEN P. ARMAGNAC, *Associate Editor*
SYDNEY OXBERRY, *Art Editor*

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FEATURES AND DEPARTMENTS

Cover design by EDGAR F. WITTMACK

AVIATION

NEW PROCESSES AND INVENTIONS

POPULAR SCIENCE MONTHLY FOR MAY, 1935

UNUSUAL FACTS AND IDEAS

NEW DEVICES FOR THE HOME

MODELS

WOODWORKING

IDEAS FOR THE HANDY MAN

In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions

Making Money With Your CAMERA

Here is a bran-NEW, exceptionally practical manual which will teach you many kinks and tricks, ways and means to take and sell pictures. Written entirely for the amateur or semi-professional camera hobbyist, it clearly demonstrates by pictures and directions the principles of picture taking that bring you photos which are marketable—and how and where to sell them.

COMPLETE, FASCINATING
Easy To Understand

The ingenious amateur who can learn how to apply some of the simple rules in this book can make enough money with his camera to pay for all his photographic activities, and lay aside some welcome profit as well.

THE TWENTY FIVE SECTIONS

of the manual cover such subjects as: Photography Isn't Difficult; Salable Pictures of People; Dollars From Architectural Photography; Pictures For Publication; Pictures For Rotogravure Sections; Ventures In News Photography; Syndicating Photographs; Pictures For The Magazines; Landscape Dollars; Selling Photographs To Manufacturers; Developing and Printing For Others; Miniature Camera Possibilities; Lantern Slides and Their Relatives; Salvaging Old Photographs; Still-Life Photography; Photographic Novelties; Accidental Profits; Nature Photography; Movie Profits; Coloring, Retouching, etc.; Invisible Light Magic; What About Stereo Photography?; Useful Accessories You Can Make; Miscellaneous Information.

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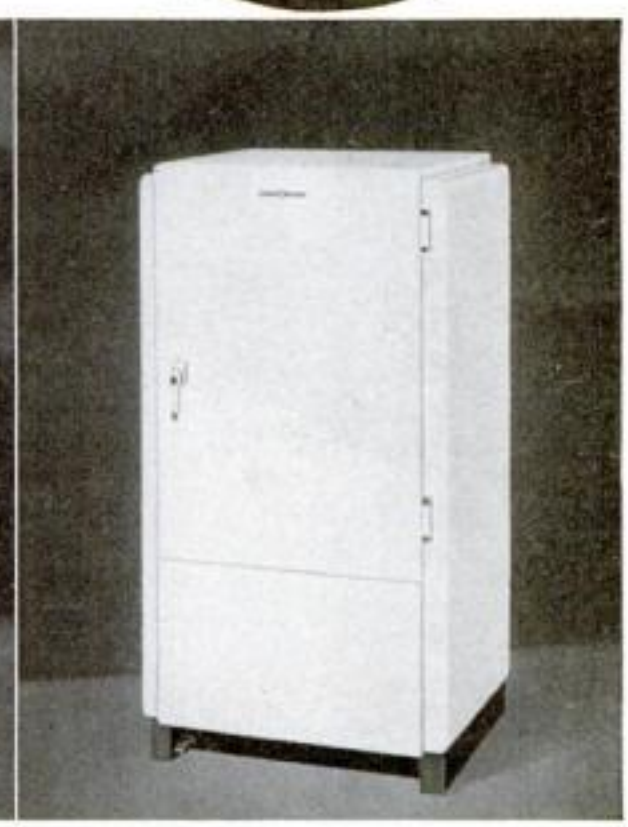
ANOTHER YEAR OF PROOF··

Still the greatest performance record of any electric refrigerator mechanism!

● Year after year General Electric Monitor Top mechanism runs on—defying time and wear. Hundreds of thousands are still serving owners without care or attention after 5, 6 and 7 years.

NOW the "ageless" G-E sealed-in-steel mechanism in all three types—Monitor Top, Flatop and Liftop



THE value of any refrigerator will be determined by its mechanical performance. No other feature is so important, for without dependable performance the savings and the convenience of modern refrigeration are lost.

The G-E mechanism is entirely automatic and hermetically sealed inside walls of steel. It requires no attention, not even oiling. The whisper of operating sound is quieted by acoustic mufflers. 3 quarts of oil are forced through the mechanism every minute under 6 to 8 lbs. pressure. Bearings are self-aligning. Valves are tested for 100 million cycles of operation. Amply powered for even unusual demands. *In actual tests with many other makes the General Electric mechanism shows from 15% to 50% lower operating cost.*

5 Years Performance Protection

In addition to the standard one year warranty every General Electric sealed-in-steel mechanism carries *4 more years* performance protection for only $5 *. . . five full years for only $1 a year!*

Only General Electric offers all 3 types of electric refrigerators—Monitor Top, Flatop, Liftop. See them at the General Electric dealer's. General Electric Company, Specialty Appliance Sales Department, Section M-5, Cleveland, O.

It Costs Less to Own a G-E!

GENERAL ELECTRIC

ALL-STEEL REFRIGERATORS

Tips *on* Painting

FOR THE HOME OWNER

By R. M. BOLEN
Secretary, Popular Science Institute

Improved materials make it possible for the inexperienced painter to get good results in small jobs around the home

ALTHOUGH there was a time when the average home owner undertook even the simplest painting job with some misgivings, research and modern materials have changed the picture. Everything from self-stirring paint cans to rubber paints and fool-proof finishes now make smooth professional strokes flow from any amateur's paint brush.

In terms of cost and effect, painting tops the list of warm-weather repairs. After a winter of driving snows and freezing rains, almost every house needs freshening up. Even though you may plan to make your present finish last another year, or have decided to give the work to your neighborhood painter, there are a score of smaller painting jobs that you can do yourself with enjoyment.

For the amateur, successful painting in general boils down to five simple rules: Start with a high-grade finish of the right type; apply it with a good brush; spread it carefully into the pores of the wood; make sure that the surface is clean before you start, and paint only when the weather is warm and dry.

Cheap paint is always poor economy, particularly when a professional painter does the job. Fully two thirds of the cost of painting a house goes for labor, so that a few dollars saved on paint is more than wasted in additional labor when the surface fails before its time. The same holds true for brushes. Cheap brushes shed their bristles, wear out quickly, and mar the surface; good brushes hold more paint, spread it more evenly, and stand many cleanings.

When you plan an outside painting job, take the weather into consideration; it will have a lot to do with your success. Heat, cold, and moisture are three enemies of drying paint and should be avoided. Heat and sun cause it to dry unevenly. Cold makes it dry rough and pitted. And moisture is the cause of blistering and peeling. Never paint during or after a rain or fog, or when rain is threatening. Pick an early spring day, and then follow the sun around the house to keep in the shade.

Too much stress cannot be laid on the condition of the surface. It should be clean and dry. Dirt should be brushed off, and if there are any places where grease or oil has been spattered or spilled, they should be scrubbed with a cloth saturated with gasoline, benzine, or turpentine.

On new work, all knots and pitchy places should be sealed with a coating of shellac or aluminum paint. This will prevent the pitch from coming through the paint later and ruining the finish.

If the building has been painted previously, all old, loose paint should be removed with a wire brush or a scraper. Blisters, wrinkles, and peelings should be scraped, and where blistering is particularly bad, the old coating should be burned off with a painter's torch.

For new wood, three coats—a priming coat, a second coat, and a finish coat—should be applied. For repainting, two coats are the usual procedure, although one coat sometimes is sufficient if the old paint is in good condition. A good stunt, used by many economical home owners, consists of applying one coat every other year instead of securing a regular two-coat job every three or four years. However, when only a single coat is used, a first or primer coat should be applied to all bare nail heads and spots that must be puttied. Putty should never be placed against unprotected wood; the oil will soak into the pores and cause the putty to crumble and loosen. This applies particularly to window frames that are to be reglazed.

In both interior and exterior painting, there are various economical kinks and short cuts that will help the amateur to get the most out of his paint. First of all, paint is a protection as well as a decoration and should be applied to all weather surfaces, particularly the upper and lower edges of a door, the top and bottom edges

of trim, the backs of shutters, and other places that are particularly exposed.

Second, use a paint designed for the particular purpose in question. Manufacturers now compound their products to best meet each individual painting problem. If you are in doubt as to what type of finish to use on some specific surface, ask your paint or hardware dealer about it; he will be more than glad to help you. Color cards and charts also are available that will help you to obtain an artistic color balance in your home.

WHEN a ready-mixed house paint is used it can be thinned most economically for the priming undercoats by first separating the oil from the pigment. Simply pour the oil that has risen to the top of the can into a separate container and scoop out half or one third of the pigment, depending on whether two or three coats are to be used for the job. Then mix the pigment for the undercoats with turpentine and a small amount of the oil. The remaining pigment finally can be mixed with the remaining oil for the final or top coat. This method preserves the proper balance between the ingredients.

Thoroughly mixed paint is one of the main secrets of a smooth finish. Don't be satisfied with one good mixing when you first open the can; stir it at frequent intervals as you progress with the work. Keep your stirring paddle handy as a reminder. Pigment has a tendency to settle out on standing and, if it is allowed to do this, the top layer in the can will be very much thinner than it should be for the best results.

The knack of matching paints can be simplified by coating one half of a small square of ordinary window glass with the original paint and the other half with the new material. When both have dried, both color and gloss can be compared easily, simply by holding the sheet of glass up to the light.

Never dip more than a few inches of your brush into the paint. Then lift it out and carefully squeeze out the excess by scraping the bristles along the top edge of the can. Turn your brush in your hand after each dozen strokes or so. This will help to wear the ends of the bristles evenly and keep the brush in shape.

Another worth-while trick that will add to the life of brushes consists of wrapping them in paper after they have been thoroughly cleaned, dried, and shaped. The paper, when carefully folded, will not only exclude all dirt and dust, but will hold the bristles in place to preserve the shape of the brush end.

THE problem of saving the left-over paint or enamel in an opened can can be solved easily by a simple trick in storing. Push the friction top firmly into place, tapping it around the edges with a hammer, and then store the can upside down. The paint will seal the crack and prevent air from entering to form a film or scum.

By following these simple rules and using modern materials, more and more home owners are pointing with pride to home-done paint jobs. Try a bit of touching up yourself this spring. You'll be surprised at the results.

KIT Q

KIT D

At right is our new miniature model of H. M. S. *Bounty*, the kit for which costs only $1.50. The model above is our Spanish galleon; at left, the privateer *Swallow*

No Time Wasted WHEN YOU USE OUR *Construction Kits*

NO. 4

KIT E

IN BUILDING a ship model, especially an elaborate one, you can easily spend the equivalent of a full day shopping around for the necessary materials. Even then you will very likely have to be content with some supplies that are not exactly what you need. The chains, for example, may be a little oversize and therefore out of scale, or the links may be of the wrong shape and proportions. Even in the case of the linen rigging cord, it may be that you need only a few feet of a certain size, yet the only way you can get it is to buy an expensive coil or spool of fishing line.

All this waste of time and effort can be avoided by making use of our ship model construction kits. They give you all the necessary raw materials, correct in size and quality, and put up in a handy package by an experienced model maker who knows just what is needed. Full-size blueprints are included in each kit.

For your convenience in making a selection, we have divided our ship model kits into three classifications. Those listed under the heading "Standard Ship Model Kits" are for making the finest of the many scale models designed by Capt. E. Armitage McCann for this magazine. Their value, when finished, is from twenty-five to several hundred dollars each, according to the type of model and the workmanship. Each of them requires a number of different kinds of hard-to-get materials.

In the next division are our simplified ship models. They are of the same general construction, but are very much smaller and require much less work. The hulls are furnished semifinished, with all the more difficult part

The historic *Hartford*—Kit L

Wanderer—Kit A

NO. 2

KIT G

of the sawing and shaping already done.

The easiest of our models to make are those given in the Model-of-the-Month Club division. All of these are balsa wood water-line models except the *Bounty*, which has a pine hull. Detailed instructions written for beginners accompany all these kits. An outstanding feature is the fact that the models listed as M, N, O, R, S, T, and X are all to the same scale of 1 in. equals 50 ft. They therefore form a remarkable set illustrating the development of American steamships.

STANDARD SHIP MODEL KITS

A. Whaling Ship *Wanderer*, 20½-in.....$6.90*
AA. Same with hull lifts sawed..... 7.40*
D. Spanish galleon, 24-in..... 6.45*
DD. Same with hull blocks shaped.... 6.95*
E. Battleship U.S.S. *Texas*, 3-ft..... 6.95*
EE. Same with hull lifts sawed..... 7.45*
G. Elizabethan galleon *Revenge*, 25-in. 6.75*
GG. Same with hull blocks shaped.... 7.25*
L. Farragut's flagship *Hartford*, a steam-and-sail sloop-of-war, 33½-in. hull..... 7.95*
LL. Same with hull lifts sawed..... 8.45*
Q. Privateer *Swallow*, 12½-in. hull with lifts sawed to shape..... 4.95†
V. Clipper *Sovereign of the Seas*, 20½-in. hull, with lifts sawed to shape..... 4.95†
Y. Trading schooner, three-masted, 17½-in. hull ..... 4.90†

SIMPLIFIED SHIP MODEL KITS

F. Liner S.S. *Manhattan*, 12-in..... 1.00
H. Cruiser U.S.S. *Indianapolis*, 12-in... 1.50
J. Clipper ship *Sea Witch*, 13-in..... 1.50

MODEL-OF-THE-MONTH KITS

M. Aircraft carrier *Saratoga*, 18-in..... 1.00
N. Four U.S. destroyers, each 6¼-in... .75
O. Liner S. S. *St. Louis*, 11-in..... 1.00
P. Cup yacht *Rainbow*, 7½-in..... .75
R. U. S. cruiser *Tuscaloosa*, 11¼-in... 1.00
S. S. S. *Savannah* (first steamship to cross Atlantic), 3½-in., and S. S. *Atlantic*, 6-in. (two models in one kit)..... .75
T. U.S.S. *Brooklyn*, armored cruiser in Spanish American War, 8-in..... .75
U. *Hispaniola*, the ship in "Treasure Island," 7-in..... .50
X. S. S. *California*, 12½-in..... 1.00
Z. H.M.S. *Bounty*, 11½-in..... 1.50

FURNITURE KITS

No. 2. Solid mahogany tray-top table 23 in. high with a 15 in. diameter top. Ready to assemble, but without finishes..... 5.40*

No. 4. Solid mahogany book trough 22½ in. long, 9½ in. wide, and 24¾ in. high over all. Ready to assemble and stain included..... 5.75*

No. 5. Solid rock maple hanging wall rack with one drawer, 19½ in. wide, 33¼ in. high. Ready to assemble and stain included..... 5.75

No. 6. Solid rock maple butterfly table, top 19 to 22 in., height 22½ in. Ready to assemble and stain included..... 6.90*

NOTE: If you live west of the Mississippi River, add 50 cents to all prices marked with an asterisk (*) and 25 cents to all prices marked with a dagger (†). Otherwise all prices are postpaid anywhere in the United States. The kits marked with an asterisk or dagger will be sent C. O. D. upon request, but the purchaser will have to pay 28 cents additional upon delivery.

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353 Fourth Avenue, New York, N. Y.
Please send me Kit.....for
which I inclose $.....(or send C. O. D. ☐)

Name .....

Address .....

City..... State.....
(Print name very clearly.)

Remit by money order, check, or registered mail. No kits selling for less than $4.00 can be sent C. O. D. This offer is made only in the United States.

Our Readers Say

When the Wind Fills the Canvas And the Tiller's In Your Hand

I HAVE had my reverses in life, like a great many others, but now I am the proud and happy owner of a fifteen-foot snipe-class boat. Oh, what a thrill there is in holding the tiller in my hand, and in feeling the wind pull on the canvas, laying the boat over on its side as the water rushes by! I wish that the editor would consider the subject of boating seriously, so that POPULAR SCIENCE MONTHLY will help us boating enthusiasts with our problems and questions. Just to give you an idea, who can answer these? 1. What is the best way to install running lights on a snipe-class boat? 2. What is a Genoa jib? 3. How can you make an effective telltale? 4. How best can you rig the mainsail sheet to do away with heavy pull on the hand holding it? 5. Can marine paints be mixed at home? 6. How? Here's expecting to hear from you.—C.E.E., Chicago, Ill.

Pictures Can Vitalize The Story of Human Progress

HISTORY always has interested me. I don't mean memorizing dates, or any dry-as-dust facts that have no relation to real life. I mean pictures of people and scenes that stir the blood and make the past wonderful as the story of humanity acquiring knowledge and wisdom. I wish you would give us a full page of pictures every now and then, emphasizing facial expressions, costumes, and architecture of the people of one particular period of change and development. I would like, too, some interesting but little-known facts on the same page. That would make POPULAR SCIENCE MONTHLY perfect, as it is all right every other way.—Z.D., Erie, Pa.

But the Waitress Wouldn't Get It If You Said 'Coffee and Tori'

IF YOU please, I should like to know what is the shortest distance between any two points on the surface of a torus, the distance to be measured on the surface. I think some of you Our Readers Say fans would like to figure that one out. Perhaps they would have to begin by figuring out what a torus is, anyway. Aha! That is where I have you! A torus is a very simple and familiar object in most American homes and in most of the emporia in which one might be tempted to stop for a little nourishment on the way home from the opera. If *filet mignon en casserole* can be chunks of beef in a crock, why can't a torus be a doughnut? And that's exactly what it is, in general shape. Do you know any other fancy names for everyday things?—J.W.A., Westfield, N. J.

'Captains and Mates Howling Their Heads Off'

THE writer is an enthusiast on the subject of sailing yacht models. When one finishes a day chasing around after a model yacht, he has had plenty of exercise, and if you think there is no science in it, just try to set the sails and steering gear on one, so that it will sail from one given point to another without acting as if it had a drunken crew aboard. This is an international game, too, and many of your foreign readers no doubt will be interested. When you see men of sixty-five or seventy together with younger men, from eighteen up, gathered about a lot of these yachts in a pond, and hear the different captains and mates howling their heads off as though they were really aboard,—ah me!—Therefore, Captain McCann, how about some plans for a fifty-800 Marblehead Class, for Class A, Class B, Class C, Class D and Class R. boats?—O.F.R., Lynn, Mass.

At Last! At Last! A Hoop Snake That Swallows Its Young

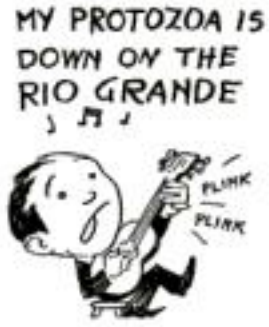
THESE people who write in about seeing snakes swallowing their young, and about the hoop snake, that serpentine hoople that you have to be seventy years old to remember having seen, —perhaps, and I say perhaps advisedly, can duplicate my unique experience one bright midnight while I was hunting and trapping gazintas on the hills of Trapezium. Just as I was about to make camp, I was suddenly startled by the sound as of an express train approaching. I looked up. There, coming down the trail was the biggest hoop snake any one ever saw. It was making about sixty miles an hour, but slowed up in time to stop just in front of my camp site. There, right in front of me, it proceeded to swallow its young. And then, just to be different, I suppose, it proceeded to swallow itself. I hope this will answer all questions readers may have on the question of snakes swallowing their young and on the existence of the hoop snake. It ought to.—J.D.W., Weiser, Idaho.

He Wants to Grow Old Beside His Microscope Articles

I GET your magazine every month, and especially like the articles on microscopy. I hope you keep up this department in your magazine for years to come.—F.A., Chicago, Ill.

Finds Protozoa Rare in High Altitudes of New Mexico

COULD W.C.M., of Peoria, Ill., give us any more information concerning the strange free-wheeling what-you-may-call-it which he says he saw through the eyepiece of his trusty microscope? For example, did this strange animalcule have any means of locomotion? If it had, how did it propel itself? Was it by means of flagella, cilia,—or did the thing just do a kind of wriggling act? At this high altitude, finding protozoa in stagnant water is very difficult; of course they would be ciliated protozoa, or infusoria. The nearest supply is at the Rio Grande, six miles away. W.C.M.'s letter reminds me of a famous story by Fitz-James O'Brien. Do any of you know which one?—G.H., San Cristobal, N. Mex.



Batters, too, Are Mystified By Ballistics of Baseball

Now that all of young America with the exception of those who like tiddledy-winks better are preparing to invade the sandlots of the nation in resuming the great national outdoor battle for baseball honors, why couldn't we have an article on the ballistics of baseball? I would like to have explained to me the reasons why a speed ball has a lower trajectory than a slow ball, and why no pitcher has ever been able to forecast the gyrations of the old-time spit-ball.—B.R., Portland, Me.

Summer's Coming, So Iceless Ice Box Looks Good to Him

WE HAVE not long to wait for hot weather now. I therefore write in to inform you that in reviewing some back numbers of POPULAR SCIENCE MONTHLY, I came across an article on how to build an iceless ice box. It was in the issue of July, 1923. A long time has passed since this article was published, and I suppose that I am asking for a big order, which is that you, if possible, bring this article up to date and republish it. You know a lot of us fellows have a lot of good junk lying around, that is good for this purpose. I am sure that you could not put in anything that would appeal more to readers.—C.C., Newport News, Va.

Here's An Enthusiastic Model Maker Who Gets Results

KEEP up the dope on ship and coach models. I don't know of any more amusing or valuable and pleasurable occupation than that which your magazine provides for me and all those who share my tastes. I spend many, many happy hours over my work bench, with POPULAR SCIENCE MONTHLY propped up in front of me, watching my own work take on perfection. I hope that you will keep on giving us a great many more articles on model making. Since May, 1933, I have built models of the U.S.S. Texas, the U.S.S. Indianapolis, the U.S.S. Hartford, the Manhattan, the Sea Witch, and, in coach

models, the Diamond, the Tally-Ho, the Cody Coach, and now I am working on the ship model of the Swallow. She's great fun, all right.—J.A.S., Baltimore, Md.

It Took Three Minds to Think Up This Problem

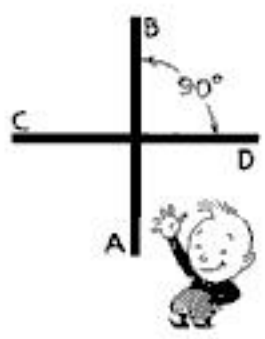
WE, THREE constant readers of that wonderful magazine, POPULAR SCIENCE MONTHLY, wish to inquire respectfully of the other readers of the aforesaid magazine, through the medium of Our Readers Say, whether they can provide an answer to the question that has puzzled us for a long time. The question is: Why are white soap suds created on dirty black water? We hope some brilliant reader out of all those who are so ready and able to give answers to difficult questions will be kind enough to answer this and help us out of the predicament in which we now are.—G.P., O.H., S.S., Moorhead, Minn.

Radio's Theoretical Side Interests This Reader

I THINK there must be a great many of us readers who, although they are interested in wireless and read the articles in POPULAR SCIENCE MONTHLY with much pleasure, are not very advanced in the theoretical side, and are unable to understand the functions of the various parts in the rather complicated sets described in your articles. I am sure that non-technical articles describing the construction of very simple one- and two-valve transmitters and receivers and fully explaining the principles on which they work would be very much appreciated by such readers as those whom I have described. If these articles proved popular, they could be continued so as gradually to lead up to the three-, four-, five-, and six-valve sets, both transmitters and receivers. Beside the articles on wireless, I am particularly interested in the articles on chemistry. I think you are to be congratulated on the wide range of topics covered and on the general turnout of POPULAR SCIENCE MONTHLY. You may be interested to know that since I first subscribed to your magazine four years ago, I have never found a poor illustration or an inaccurate article in it, I am happy to say. —T.S.L.B., London, England.

Strange Paths Taken by Bullets Call for Explanation

HERE'S another simple one for F.C., and all others who are interested in solving it. Mr. X sets up a target at B and fires with no wind and perfect sighting, from position A. The bullet hits to the right of the point aimed at. He then reverses his position, placing the target at A and firing from B. The bullet hits at the same distance to the right. Any number of trials from either position gives the same result. However, when he fires from either C or D along line CD, at right angles to AB, his bullets always strike where aimed. In what directions do lines AB and CD extend? Explain exactly why the effects described above exist. Under what conditions would bullets swing to the left by about the same distance? Under what conditions would the shots first curve to the right for a distance, then begin to swing to the left?—R.E.B., Cincinnati, Ohio.



Through the Earth and Back In Eighty-one Minutes

CONCERNING G.P.O.'s letter about dropping a stone down a tunnel from here to China. If all traces of air were removed from the proposed tunnel (and if we neglect centrifugal force due to the earth's rotation and the attraction of other heavenly bodies) the stone dropped in at New York would travel to China and come to a stop there at the same height above the ground as the height from which it was first dropped into the tunnel. Unless it were stopped, it would, of course, fall back into the tunnel and return to New York. One round trip in this tunnel would take nearly eighty-one minutes, and the maximum velocity of the stone (at the center of the earth) would be five miles a second. Unless stopped, the stone would fall back and forth forever,—an example of simple harmonic motion more or less like a pendulum's. If air were present in the tunnel, it would "damp" the motion, and we would have damped harmonic motion. In this case, the stone would stop farther from the surface of the earth each time, eventually coming to a rest at the exact center.—C.V.S.R., Cambridge, Mass.

Making Faces is Fun, When You Use Sculptor's Methods

I AM a devoted reader of certain daily newspapers, and, in the course of my reading, I wade through a good deal of interesting suggestions on how to enrich one's life with recreation and avocation. But just the other day I came across an item in a Los Angeles paper, that has inspired this letter to you. The article said that a great many people with inclination toward making interesting objects have taken up the fad of modeling and sculpturing life-sized portrait heads in clay and similar plastic substances. Such a craft ought to be fun. How about it?—P.W., Fresno, Calif.

As the Basso Said to the Tenor, 'One of Us is Wrong'

I BELIEVE that W.H.'s answer to the helix problem is wrong by more than twelve inches. After my integrations, substitutions and headaches, the answer I got was 248.26 inches. So now what? Either we're both wrong, or one of us is right.—F.S.M., Aurora, Ill.

Treasure Ship Sank Near Golden Gate Bridge

THE article called "Fighting the Tides of the Golden Gate" thrilled me. As a child, in old Frisco, I stood with a crowd gazing at a red buoy that floated a little to the left of the present fender under construction for the Golden Gate Bridge. This buoy was supposed to mark the spot at which the Pacific Mail steamship *Rio de Janeiro* had struck something in the fog and gone down with 642 persons on board. The vessel was returning from the Orient, and the captain lay outside afraid to enter the strait until the fog lifted. Against his better judgment he was persuaded to come in. At the Government inquiry, it was brought out that soldiers on post ashore could hear passengers talking on the steamship. It struck. Passengers rushed the boats, and some of them were shot down by the ship's officers. One man got ashore. He swam in, through the fog. The ship was never found. To prove it didn't drift over the bar and out to sea, the captain's body washed ashore a month later. A deep sea diving company brought up a hatch cover. I have heard there were $2,000,000 in gold in the purser's safe. The piles sunk for the new bridge must have come very close to the steel grave of hundreds of Americans who crossed the Pacific only to die within a few feet of their native land.—J.S.C., Trinidad, B. W. I.

Cuts Corners to Solve Problem of Water Container

IF H.M., of Utica, Mich., will cut out a three-inch square from each corner of his eighteen-inches square made of tin, he will find he has sufficient material left to form a water container that is twelve inches long, twelve inches wide, and which will have a depth of three inches. It will hold 432 cubic inches of water. This amount is the greatest possible for it to hold. Of course he can use the four small squares of tin to reinforce the corners of the container. I must say that the apparent solving of this problem has left me with a new one,—what best to do with the extra tin.—T.W., New York, N. Y.

Some Organs We've Heard Have No Principle

I HAVE had much fun reading Our Readers Say. Will some one give me the principles of the reed organ and the pipe organ? I am sure someone can, you cover so great a variety of interesting subjects.—A.D.C., Detroit, Mich.

Photographing a Blue Sign With Gold Letters on It

I HAVE just read H.B.'s letter on Black Lightning. He evidently doesn't know how color affects a photographic film. He says his film was not sensitive to red (panchromatic), therefore, his "black lightning" must have been red. If he were to photograph blue or violet, he would find it reproduced as white, because the most actinic rays are at the blue end of the spectrum. I wish he would try to photograph a gold sign on a blue (quite dark blue) background. He would find that he had a photograph of black lettering on a *white* background,—just the contrary of what he expected. A panchromatic film would reproduce the blue (Navy or Royal Blue) very much as it would reproduce the gold writing, unless a yellow filter were used, in which case the sign would be reproduced correctly. Hoping H.B. sees this.—L.J., Winnipeg, Canada.

From the Cow Country, a New And Startling Use for Milk

I READ, in a recent issue, in the columns of Our Readers Say, with extreme pleasure, the article signed by W.D.G., of Essex, Iowa, in which he gave explicit directions for fixing an erratic alarm clock. It caused me to consult Mr. Webster in order to thoroughly understand all the terms, and I find that my experience checks with his rules with one exception. He recommends that the clock be boiled in vinegar. Maybe that would be O.K., but milk is also good. Now will some kind reader, who is a plumber, please give us some rules for assembling the union that connects a water jacket in a range to the hot water tank, by means of a pipe, so that the union will not leak. In my opinion, these instructions are needed just as much as the instructions on erratic alarm clocks are needed.—J.V.H., Laramie, Wyo.

A sheet of solid reinforced steel over your head

CHEVROLET'S TURRET-TOP BODY BY FISHER

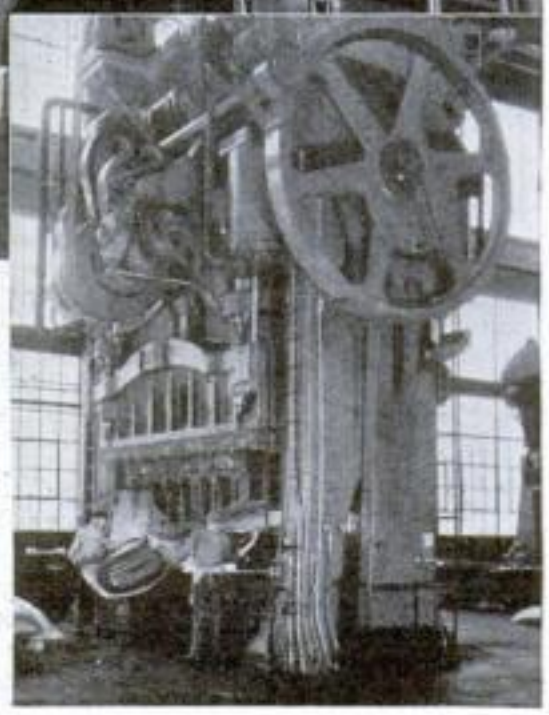
affords additional strength and safety

To the overhead protection of Chevrolet's new Turret-Top Bodies there is added the further protection of extra-strong construction throughout. The floor—the cowl—**the rear panel—and the two side panels—all are of rugged steel heavily reinforced to give maximum safety.**

Men who have examined Chevrolet's new Turret-Top Body by Fisher pronounce it the most important contribution to motoring safety in the history of body-building. The entire roof consists of a *solid sheet of seamless steel.* Moreover, this roof is arched and reinforced by sturdy bows of heavy gauge metal to make it even stronger and more durable. Turret-Top construction—*exclusive to Chevrolet in its price class*—**is a vital reason why so many people are choosing** *Chevrolet* **for quality at low cost.**

CHEVROLET MOTOR COMPANY, DETROIT, MICH.

Compare Chevrolet's low delivered prices and easy G.M.A.C. terms.
A General Motors Value.



Giant presses—the only ones of their kind in the world—are used to draw and shape the tough steel into Chevrolet's new Turret-Top Bodies under pressures as high as 750 tons.

CONSIDER CHEVROLET'S MANY EXCLUSIVE FEATURES

Turret-Top Body by Fisher
(with Fisher Ventilation System)

Blue-Flame Valve-in-Head Engine
with Pressure Stream Oiling

Improved Knee-Action Ride

Weatherproof Cable-Controlled Brakes

Shock-Proof Steering

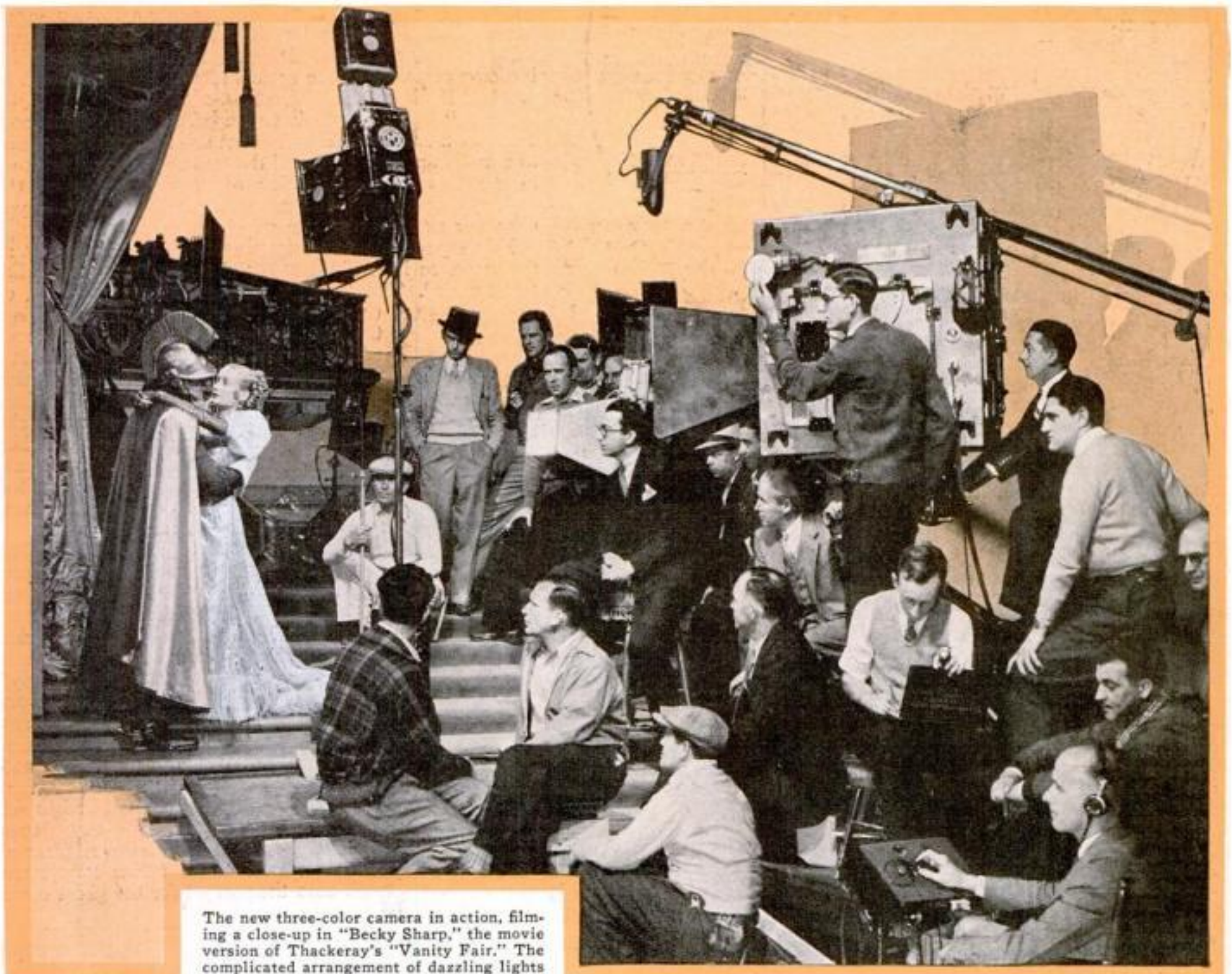
MASTER DE LUXE COACH

CHOOSE CHEVROLET FOR QUALITY AT LOW COST

POPULAR SCIENCE Monthly

MAY 1935 VOL. 126 No. 5

RAYMOND J. BROWN, *Editor*



The new three-color camera in action, filming a close-up in "Becky Sharp," the movie version of Thackeray's "Vanity Fair." The complicated arrangement of dazzling lights and sound-recording apparatus is plainly shown. Brilliant costumes and settings will figure largely in this new phase of the films

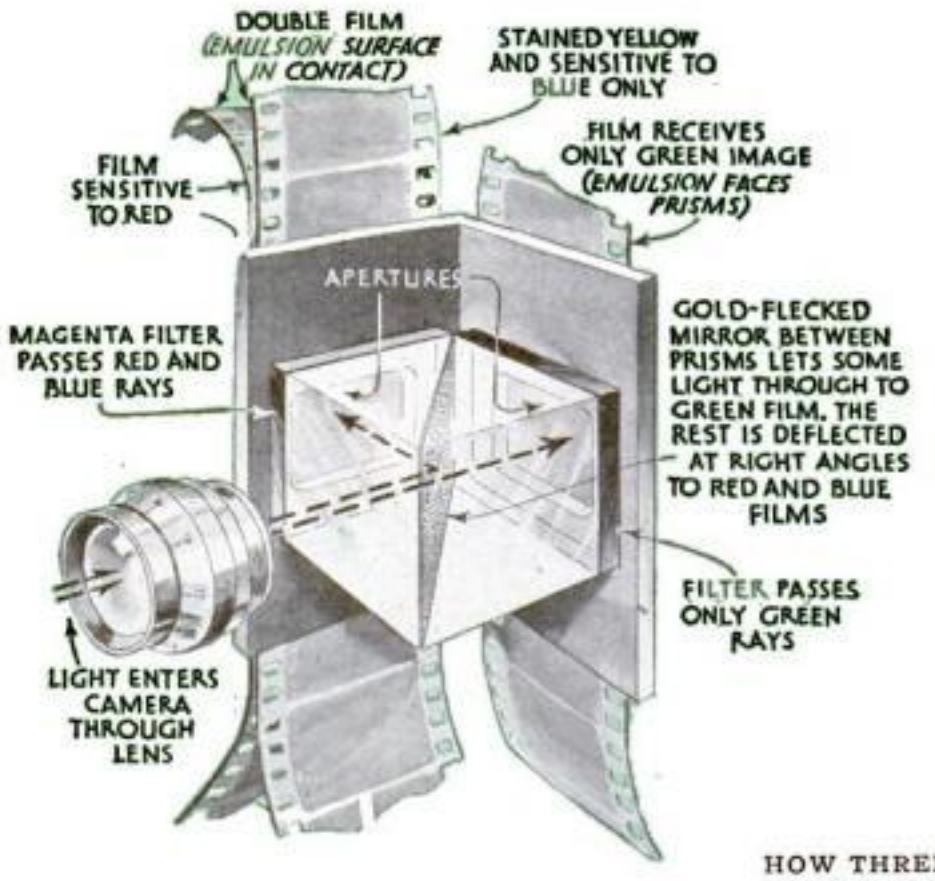
Pictures in Full Color

OPEN NEW ERA IN MOVIES

By ANDREW R. BOONE

THIS year definitely ushers in the era of color in moving pictures. Every producing company plans at least one picture containing color sequences, and one has scheduled seven full-length features, all in color. More than a hundred colored features, short subjects, and cartoons will appear next season.

Within three years, a producer estimates, half of the 3,600 feature pictures produced each year in Hollywood will reach the nation's 18,263 theaters in colors, and in another two years all pictures will be spreading the colors of the rainbow across the screen. Unlike sound, which swept over the motion-picture



HOW THREE COLORS ARE RECORDED AT ONE TIME

The diagram above shows the construction of the new color camera and the principle on which it operates. Three films are exposed at once, each making a record of one color as it appears in the picture

Above is a print from the film on which the red portion of a scene has been recorded. The negatives are not colored, but show a black-and-white version of the colored part. At right, a print of the blue version

Above is a print from the negative reproducing the green part of the picture. In the actual process, the positives are printed in the real colors

ginning two years ago when John Hay Whitney and Merian C. Cooper, the latter a Hollywood producer, engaged Robert Edmond Jones, New York theatrical designer, to make a series of tests in an effort to learn whether "moving paintings" could be created with a degree of perfection matching that of the camera.

Jones found that moving pictures are taken in ordinary white light, without color filters, or in sunlight. Shadings to express human emotions are made only in lights and shadows. In the theater he had made use of colored lights for several years to express emotions.

In one of his early tests he first photographed, with black and white, a woman dressed in orange, against a green background. Following this he recorded the same scene with the color camera. Inspection revealed a beautiful blending of colors as the actress moved back and forth in front of the backdrop.

Then the designer took an important step which now promises a final combination of art and science. He applied to a motion picture portrayal the technique he had built up in the theater—the throwing of "mood" lights on the actress. Lovely pink and warm amber lights were played upon her as she acted a romantic sequence.

This experiment added immeasurably to the beauty of the scene, so he decided to try changing the lights as her mood varied. Twenty boys, each manning a "gelatin", or colored spot light, stood off-stage when the camera began to grind again. Jones called for first one combination of lights, then another. At first the actress was enveloped in cold, tragic blue. This drab color literally painted her in gloom as she contemplated the loss of her lover. Then she heard footsteps and turned expectantly, hoping for his return. As she smiled the screen changed to the colors of dawn, her face flooded with rose and yellow.

The test proved to Jones' satisfaction that lights could be used effectively and that the face would "take" these changes. But what of their psychological effect on an audience? Could the interplay of lights lift an audience into ecstacy, or plunge it into the gloom bred by impending tragedy?

As I sat in a Hollywood projection room observing the results of these experiments I witnessed a scene far more powerful than anything possible in only black and white.

John Barrymore had volunteered to act a scene from "Hamlet." For days Jones and Barrymore studied effects, planned the short test. Then I saw Barrymore walk onto the parapet for the ghost scene

industry almost in a day five years ago at a cost of nearly $1,000,000,000, the facilities for production of pictures in color rest largely in the camera and laboratory methods for turning out finished color prints and will not require huge outlays for stages and costly technical equipment.

Color affords much more emotional power than do pictures in black and white. Already, combinations of colors are being used to intensify dramatic effects just as they are by a painter who, with his brush, not only recreates a scene from nature but also gives it the desired artistic emphasis.

Photography in color combines the effects of both photography and painting. Whether producers will be able to reproduce great outdoor scenes in colors remains to be seen, for they have found that for the best effect they must control not only the color, but the light as well.

The present boom in color had its be-

This electrical device makes possible the accurate focus required in color photography. The pointer shows the distance from lens to subject

At the right is seen a portable developing tank which is used for developing short sections of film. This is done off-stage after each scene is filmed, to check the results being secured

with his friends, Horatio and Marcellus. A soft blue moonbeam lighted his face, while a warm, glowing red from a brazier cast its romantic beams across Barrymore's figure.

Then the ghost of his father began to appear. Not a wraithy form, but the effect of the ghost's presence—in lights. The strong moonlight gradually dimmed, while a cold, harsh, greenish blue cast an unearthly radiance over his face. The actor turned, looked full into the ghostly light. With words and acts he dramatized the presence of the departed figure. Lights painted Barrymore's face with a forbidding fear.

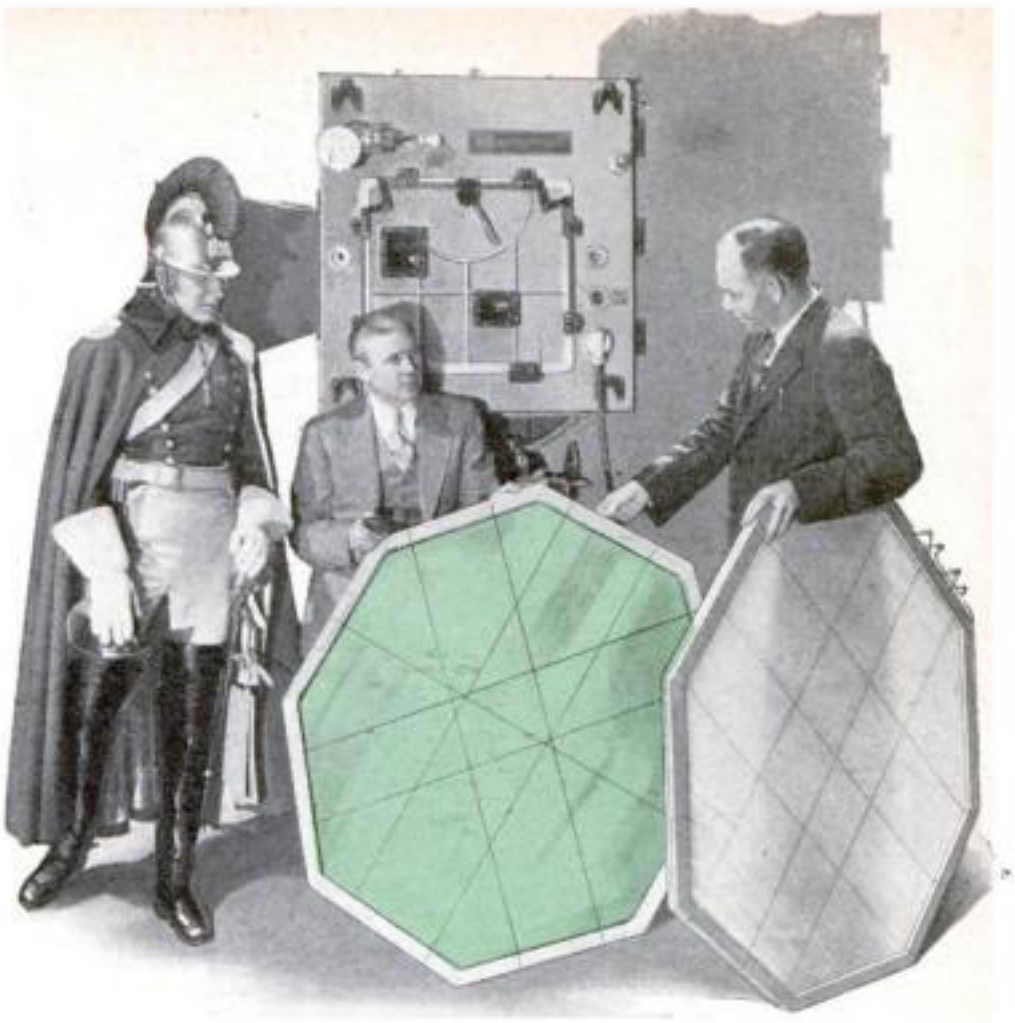
From that simple beginning, color pictures have progressed rapidly in recent months. Following the simple test with mood lights, Pioneer Pictures, Inc., produced a two-reel feature, "La Cucaracha." Such was the excellence of its color that this picture stands today as a landmark which ushers in the era of color.

WITH the recent completion of "Becky Sharp", the film version of Thackeray's "Vanity Fair", the first full-length moving picture using all the colors of the spectrum was made ready for the screen. The picture is a "moving painting", in which richly costumed actors move about on painted sets, made possible by a combination of art and a new camera which has the power of separating a beam of light into the three colors—red, green and blue.

For several years, photographic experts have sought to perfect a process by which all three colors could be registered on moving-picture film. Early efforts at natural-color photography included only red and green and their combinations. Recently a camera has been developed which exposes three films simultaneously, the image of one color registering on each. Through a complex physical and chemical process these black-and-white images are translated into colors and finally are printed in an infinity of combinations on a single film for showing in the same theater projectors which today reproduce black-and-white pictures.

The new camera acts much like a human eye. Whereas the eye receives color impressions through three nerve centers, each transmitting a single color, each of the three films registers its impression of a single color. One negative faces the lens, while two, one directly behind the other, are placed at right angles to the lens.

As the light rays pass through the lens they strike a glass, set at an angle of forty-five degrees and flecked with countless bits of gold to form a partial mirror. Some of the light passes between the flakes of gold and strikes the film coated with a green emulsion. The rest is deflected by the gold onto the two side films. The deflected light first filters through a magenta (red) glass, which permits both red and blue light to reach the red- and blue-coated films. The first film, being dyed yellow, stops the blue light and registers an image of blue objects. Red goes through the first to register its image on the rear film.



Huge color filters like these, made of gelatin, are used to paint the scenes with light of the colors desired. A wide range of coloring gives realistic effects

Robert Edmond Jones, artist and designer, views a painted set through an instrument which shows it in three dimensions. Left, the remarkable color camera which may revolutionize the movies

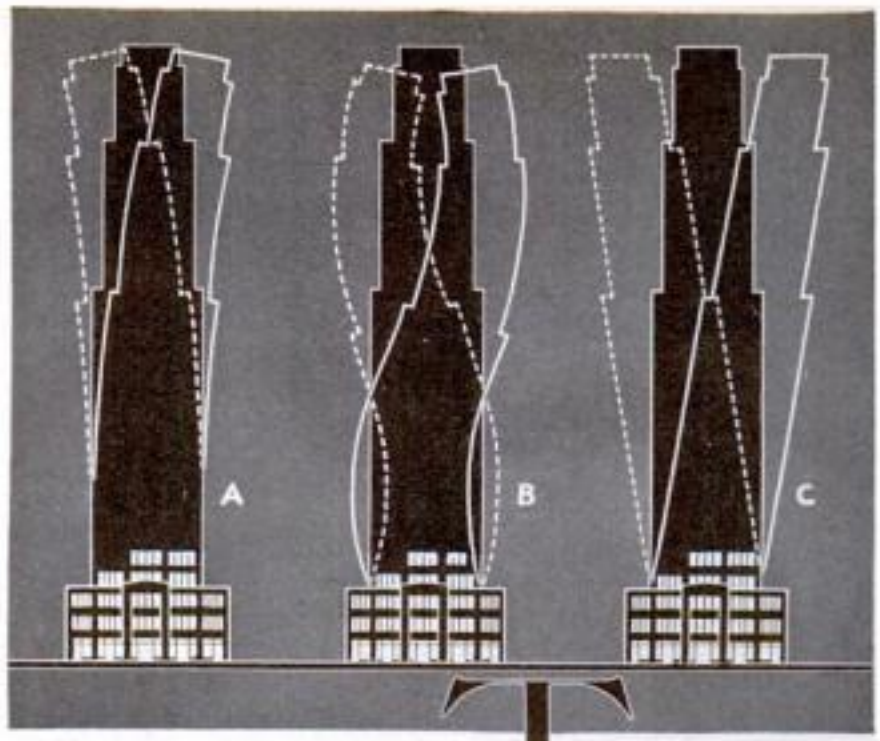
What the camera really does is to split each ray of light into three colors, registering one color on each film, thus taking three pictures of the scene in front of the camera. The negatives do not actually change color. The green film, for instance, reproduces only a shadowy black-and-white version of the green portions in the scene. Likewise the red and blue negatives preserve individually those colors in accordance with the intensity of the tone which reaches them.

After a scene is photographed, these black-and-white records are transformed into colored negatives, known as matrices, by pressing them against special film coated with gelatin. When "developed" in warm water, the shadows on each expand and form images in relief. Each matrix is then dyed, not the color which it photographed, but the complementary color. For instance, the green matrix becomes magenta; the blue matrix, yellow; and the red, blue-green.

Following the dyeing process, all three matrices are pressure-printed onto a single film. Each matrix, having been dyed only over the relief sections of the image it has recorded, prints where the negative previously recorded little or no color; the complementary color prints in the color originally recorded in light and shadow on the negative exposed in the camera. After all three matrices have been printed on a single new film it is in natural colors and is ready for showing in a standard projection machine.

The first picture made with the color camera was "Toll of the Sea", which appeared in 1921. Color languished for eleven years, until "Three Little Pigs" appeared in three colors. The third color—blue—brings more *(Continued on page 116)*

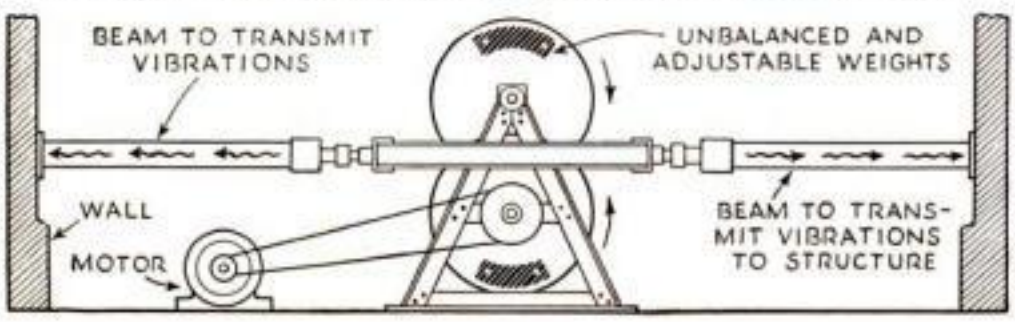
How does a building behave when it is rocked by an earthquake? Does it vibrate stiffly, like a rod (A), or sinuously, like a snake (B)? Or does it sway, with the floors remaining level (C)? Science is now seeking the answer



Tiny Machine Shakes Huge Buildings in Novel Earthquake Tests

A MACHINE THAT MAKES SYNTHETIC EARTHQUAKES

Experts of the U. S. Coast and Geodetic Survey using the vibrator which finds the vibrating pitch of buildings. The drawing below shows how the machine is constructed and the manner in which it is installed for tests



LOOKING like an oversize, three-wheeled grindstone, a weird machine recently whirred atop bridges, dams, and office buildings of the West in a strange series of tests. Through its use, a crew of two or three men can cause a giant dam or a huge skyscraper to vibrate infinitesimally throughout its mass, showing exactly how it would act under stress and shock.

Just how a machine no larger than a light roadster can sway a gigantic mass of steel and concrete, is a miracle of physics. Army leaders long have known that a company of soldiers should break step when crossing a bridge. If the tread of marching feet should fall in tune with the structure's natural "pitch," powerful vibrations would be set up that might cause the bridge literally to tear itself to pieces. That principle, used in miniature, forms the basis of the "earthquake machine."

Three rotating steel disks, each having a variable weight attached to its circumference, create artificial earthquakes which thrill through the structure under test to betray its natural period of vibration. As the off-balance wheels gradually come to rest after being spun at high speed, they produce back-and-forth impulses slowly dropping from twelve a second, to zero. When they happen to strike the natural "pitch" of the structure, strong pulses are built up, which in turn are detected by a recorder attached to the building. This recorder is really a little seismograph in which a needle beam of light stabs a moving photographic film to make a complete record of vibration.

Knowing the pitch of a building is important to engineers and architects because it enables them to estimate a structure's ability to resist the shock of earthquakes or of cyclones and sudden bursts of wind.

To get this information, experts of the United States Coast and Geodetic Survey for months carried portable instruments to various large buildings in the west and made records of their natural movements. Setting up sensitive recorders like small seismographs, they found that every large structure is constantly in motion. Wind pressure and the jar of passing traffic cause tall office buildings to vibrate and sway like trees in the wind. Of course, the movement is very slight—perhaps only a few ten thousandths of an inch at the top of a tall building; but it is enough to register upon delicate instruments.

That fact made it possible to measure the pitch of the structures, for analysis of the minute ripples traced upon sensitive photographic film always showed a predominant wave, the natural frequency. More than 140 buildings, thirty large tanks, and dozens of bridges, dams, and piers thus gave their records to science, and the Survey man in charge of the work hopes to add 500 more to the list before the end of the year. In correlating their results,

Another view of the earthquake machine, showing the motor that drives the off-balance wheels to set up small vibrations in buildings

HOW THE PITCH OF A STRUCTURE IS FOUND

When the impulses produced by the earthquake machine strike the natural pitch of the building, the strong vibrations resulting are recorded as in the strip at the left. Below, the recording instrument, resembling a seismograph

By
JOHN E. LODGE

experts soon found a better way than merely to depend upon the chance impulses of wind and traffic. Why not create small artificial earthquakes that would search out the natural pitch, setting up spontaneous vibrations that would probe more deeply into these mysteries? That is what the three-wheeled vibrator does.

The work will be further aided by a new instrument which makes records on four floors of a building at once. By keeping one instrument in place as a key recorder, and testing the other floors, three at a time, scientists will learn exactly what takes place at each floor, and locate the zones of weakness.

Earthquakes usually have a predominant frequency that is most to be feared. For example, Japanese scientists found that the quakes which shook their island had an average period between three-tenths and four-tenths of a second on rock. If a building can be "tuned" to some remote pitch, it will respond but feebly, if at all, to earth shocks.

Experts of the U. S. Coast and Geodetic Survey have converted the whole state of California into a great laboratory where the principles of construction are being studied in an effort to answer many questions now puzzling science. How does a building behave when it is racked by an earthquake? Does it vibrate stiffly, like a rod, or sinuously, like a snake? Do the floors tilt, or remain level? Does a granite foundation help?

So far, engineers have learned that the higher a building is, the more slowly it vibrates; that its pitch also decreases with its width and stiffness; and that a building that is well tied together so as to move as a unit, best resists injury.

Out of the welter of wreckage left by the disastrous earthquake of March, 1933, have come facts that will be of direct aid to engineers everywhere in planning new buildings; for many of the principles of good construction apply equally well to safeguarding structures against storms.

Strangely, it was not the tall buildings that suffered most, but those from one to three stories high. Frame houses were but slightly damaged, possibly because of their flexibility.

In addition to its sidewise, lunging thrust, the big earthquake had two major vertical movements—one a slow rise and fall of the ground, the other a very rapid up-and-down tremor. Probably the fast tremors crumbled the mortar between bricks of buildings and made them easy prey for the later shocks.

On the other hand, properly designed brick buildings came through without great damage. Brick construction has been approved as a safe method of building, provided it is properly tied together. One brick building survived a very bad earthquake because discarded cables from an old mine had been embedded in the mortar joints to lend strength. The same principle is being applied in modern reënforced brick construction.

Many lives were lost simply because unnecessary parapets, decorated corners, projecting cornices, and superfluous ornamentation came crashing down into streets with fatal effect.

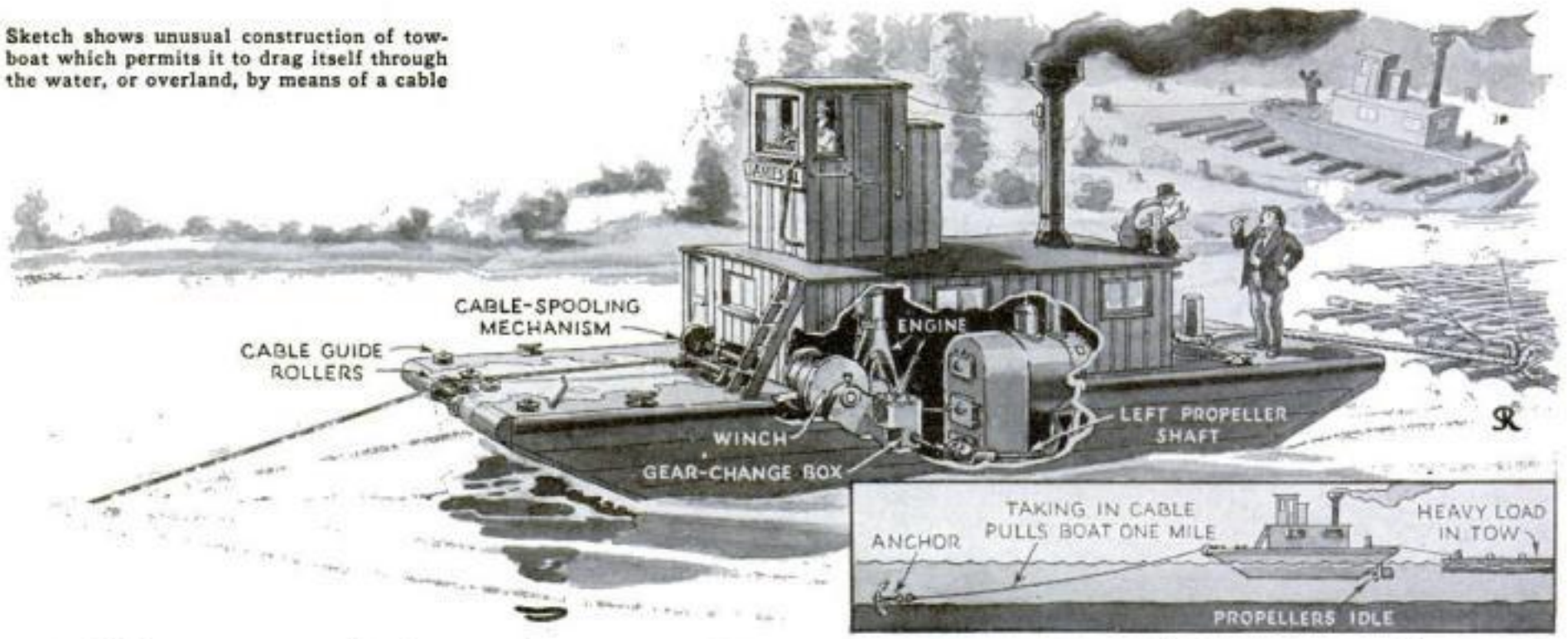
Safeguarding against severe stresses now is possible through concrete, made with pumice instead of gravel, to reduce dead weight sharply; and through light weight metals in the framework to make structures more flexible and lighter. Use of such materials, plus proper bracing in the frame, may produce structures with a vibration wave safely out of range of shocks.

One expert has suggested that tall buildings be made with diagonal bracing much weaker than that of the framework. If a severe earth shock came, it would break this bracing, throwing the building entirely out of tune with the tremors.

Another authority recommends that engineers make the first floors of large buildings more "elastic", allowing easy relative motion between the structure and the ground—a sort of buffer floor to absorb the shock of quakes. Others recommend greater protection against lateral forces.

If the weaknesses in building construction are corrected, the structures will be much safer for the occupants. One new plan for a business block calls for shatterproof windows and reënforced concrete construction with encircling beams like barrel hoops to make the whole building a unit. Another structure, the Edison Building in Los Angeles, has been designed to withstand a horizontal force equal to one tenth the total dead weight of the building. This amounts to a sidewise thrust of more than 8,000,000 pounds at the first-floor line. Both riveting and welding strengthen the frame, and the structure will withstand forces far greater than those of past earthquakes.

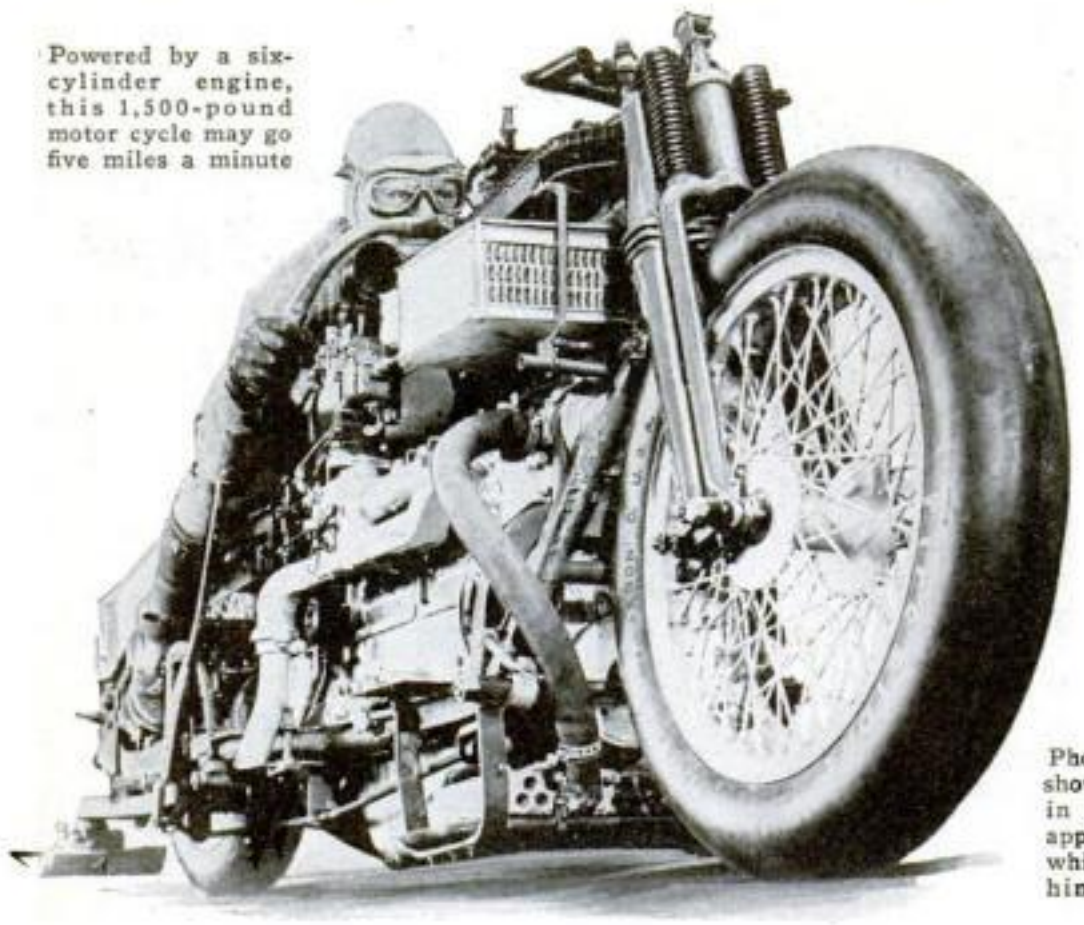
Sketch shows unusual construction of towboat which permits it to drag itself through the water, or overland, by means of a cable



Alligator Towboat Can Drag Itself Overland

AT HOME on water or land, "alligator" towboats used in Canadian logging operations employ a novel means of propulsion. Before picking up a heavy, floating load of pulpwood, a boat of this type runs ahead and drops anchor. Then it returns, paying out the long anchor cable, and makes fast to the load. A gear shift transfers power from the propellers to a drum that winds up the anchor cable, pulling the boat and its load a mile at each haul. When the towboat finishes its work in one lake, it hauls itself overland to another by its anchor cable, riding on crude rollers as shown in the corner of the accompanying sketch.

Powered by a six-cylinder engine, this 1,500-pound motor cycle may go five miles a minute



GIANT MOTOR CYCLE TO TRY FOR RECORD

FIVE miles a minute! As this issue went to press, Fred Luther, dare-devil racer of Los Angeles, Calif., was preparing to attempt this speed on a special motor cycle powered by a six-cylinder automobile engine. So long is the machine that the handlebars are placed near the center and turn the front wheel through a chain-and-sprocket linkage. Steel plates at each side of the rear wheel, lowered to earth by a hand lever, serve as drags for braking and as supports for the motorcycle while it is standing still.

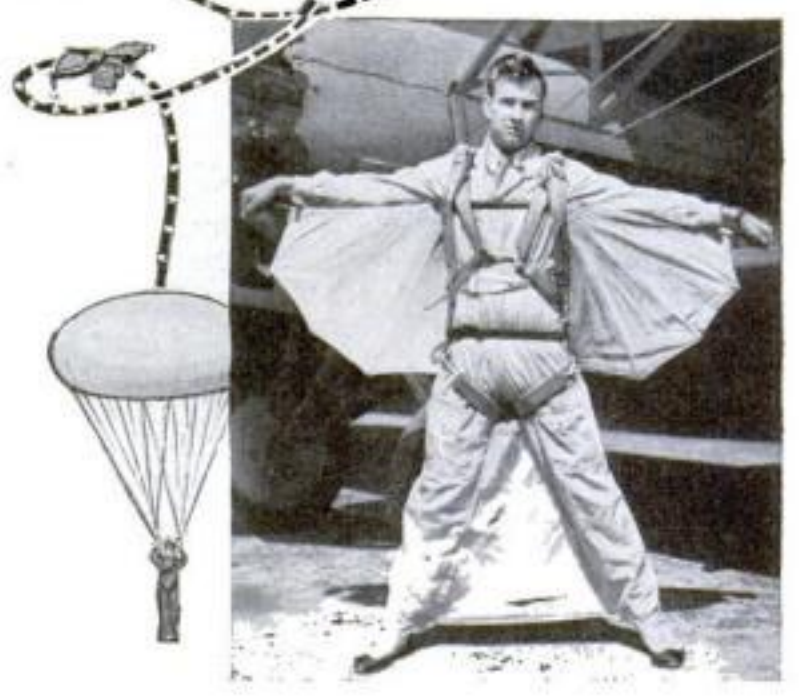
TOOL PICKS LOCKS

LOOKING like a pistol, the odd tool seen above is used by locksmiths for picking locks. A point, inserted in the lock and vibrated by the trigger, works the tumblers of most locks to the open position.

HUMAN BAT MAKES A THREE-MILE GLIDE

WITH fins strapped to his arms, and webbing between his legs, Clem Sohn, stunt parachute jumper, recently dove from a plane 12,000 feet above Daytona Beach, Fla. Two thousand feet down, he spread his arms and legs and found he could guide himself at will. The human bat glided, wheeled to left and right, and made three loops. Then, unfurling his 'chute at 6,000 feet, he landed safely three miles from his starting point, after being in the air twice as long as in a normal descent with a parachute alone.

Photo at right shows Clem Sohn in the batlike appendages with which he steered himself in air



Doll House Has Electric Organ

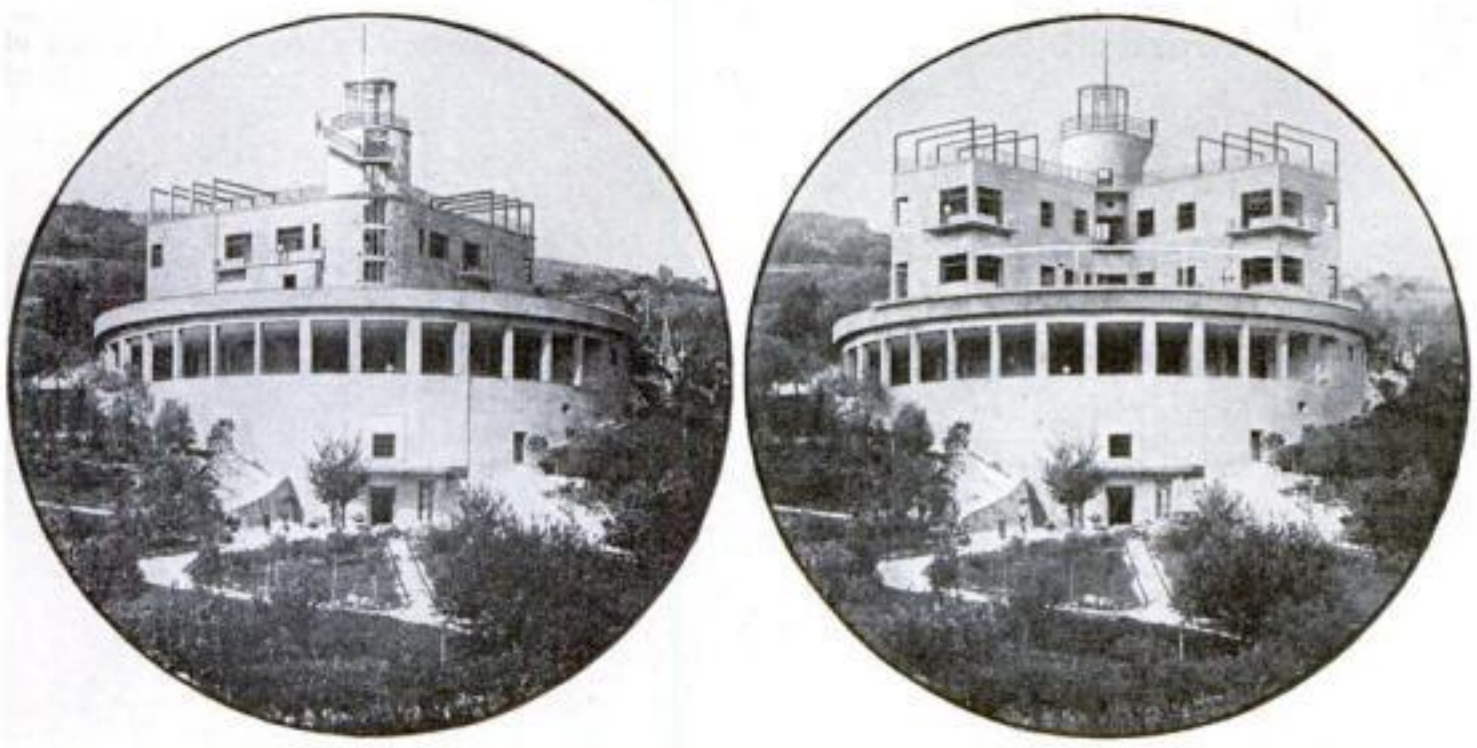
Tapestries on the walls of this miniature dining room depict exploits of the Knights of the Round Table

Colleen Moore, owner of the $500,000 doll house, exhibits some of the tiny volumes of its library

A FABULOUS doll house whose construction required the efforts of more than 700 workmen, artists, and master craftsmen, is soon to be exhibited throughout the United States and abroad. Built for Colleen Moore, movie actress, at a cost of nearly half a million dollars, the eleven-room castle holds all that its imaginary occupants, a fairy prince and princess, could desire for comfort and entertainment. A miniature electric organ, fifteen inches high and fashioned of solid gold, plays music by remote control. Real electric light bulbs, no larger than grains of wheat, illuminate the living room from a golden chandelier strung with pear-shaped diamonds. Walls are decorated with miniature paintings by noted artists, and famous authors have contributed midget volumes in their own handwriting for the library. Figures and pictures depict storied people of legend and fable—Alice in Wonderland, Old King Cole, Little Bo-Peep, the Knights of the Round Table, Cinderella, and a host of others. The whole model measures nine feet square, and its turrets rise fourteen feet into the air. Proceeds from its projected tour will go to hospitals for crippled children.

Above, the fifteen-inch electric organ, played by remote control. Left, the diamond chandelier equipped with the smallest electric bulbs made

"SUNFLOWER HOUSE" REVOLVES TO FOLLOW THE SUN



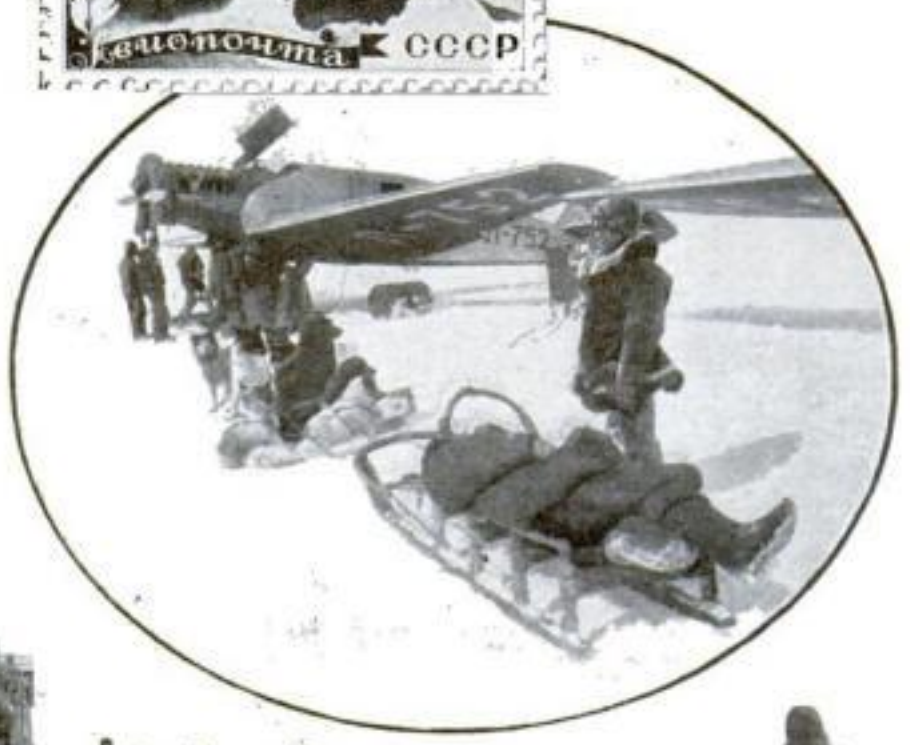
Two views of the unique revolving house, taken from the same point of vantage at different times of the day

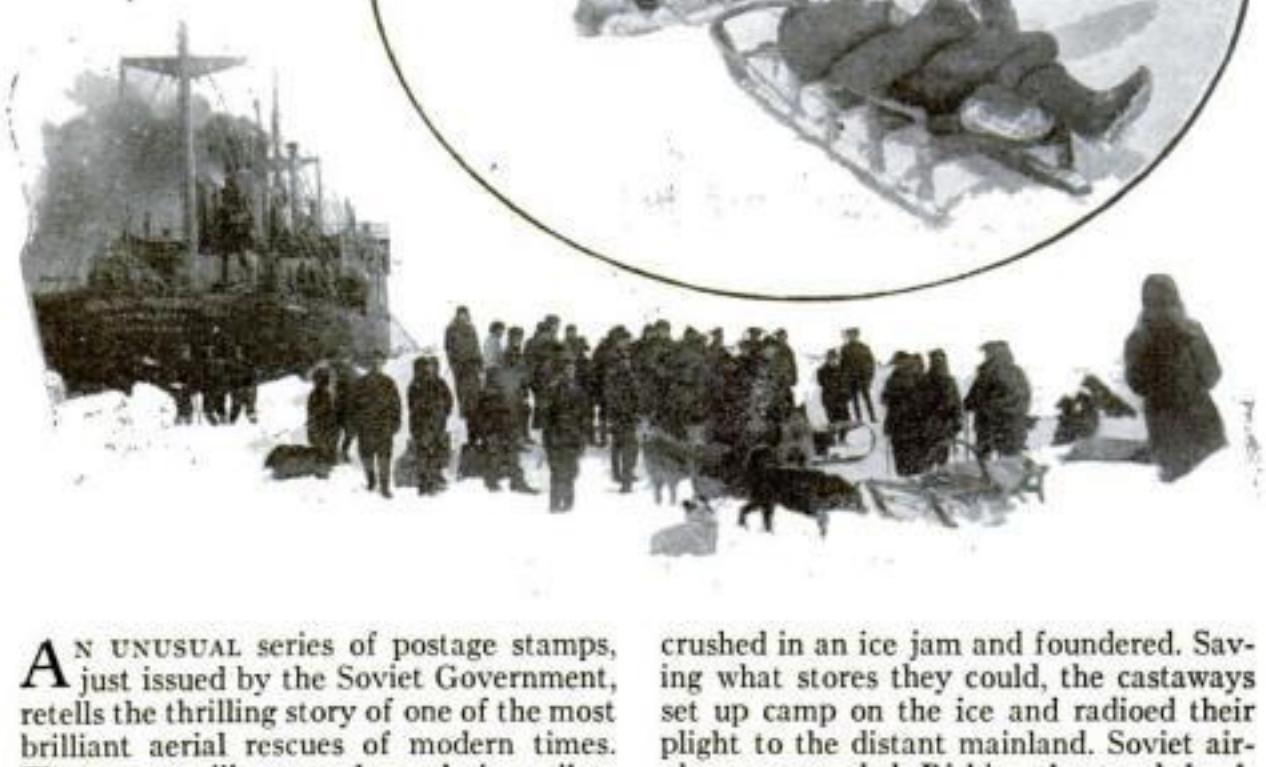
So THAT he may have sunshine in his living rooms at all hours of the day, a resident of Marcellise, Italy, has built a revolving house. The entire upper portion of the odd residence, comprising two stories and a central tower, rotates bodily upon the stationary base to follow the sun, completing its circular arc in nine hours and forty minutes. Because of the slow rate of movement, a small power plant of only three horsepower capacity is sufficient to handle the massive weight of the rotating part of the structure. The photo shows the house in two positions.

STAMPS COMMEMORATE ARCTIC RESCUE

The design above shows the Arctic shipwreck victims welcoming plane

The design on the stamp shown at the left pictures the expedition ship, the *Cheliuskin*, fast in the ice. Below, from photographs, are reproduced scenes of wreck and rescue





AN UNUSUAL series of postage stamps, just issued by the Soviet Government, retells the thrilling story of one of the most brilliant aerial rescues of modern times. The stamps illustrate how daring pilots saved 101 men and women marooned on the ice last year, when the exploring ship *Cheliuskin,* attempting the treacherous "Northeast Passage" from Leningrad through the Arctic Sea to the Pacific, was crushed in an ice jam and foundered. Saving what stores they could, the castaways set up camp on the ice and radioed their plight to the distant mainland. Soviet airplanes responded. Risking the rough landing on the floe, they plied between the camp and the mainland for two months until every member of the expedition had been rescued. A new title, "Hero of the Soviet Union," was bestowed upon the aviators.

DESK LAMP IS PORTABLE

A HINGED arm permits a new desk lamp to be folded, as shown above, so that it may be tucked into a desk drawer or a traveling bag. When closed, the shade and the base form a ball that takes up little space. The support serves as a handle for carrying. The lamp takes a standard bulb and has a universal joint at the base, so that the illumination can be directed as desired.

BAG GIVES SHOWER BATH

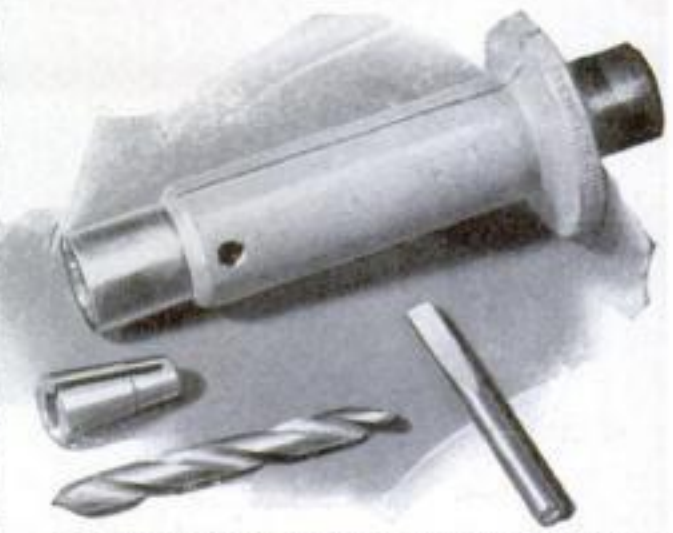
AN AIR-TIGHT and waterproof bag, now available to campers, serves a variety of purposes. Filled with water and fitted with a spray nozzle, as shown, it makes a handy camp shower. To inflate an air mattress, the camper has only to detach the spray head, connect the outlet tube to the mattress, and sit on the bag, repeating the operation three times. On breaking camp, the versatile bag may conveniently be used for carrying personal effects.

GREASE CHARGES FIT GUN

AUTOMOBILE grease packed in cartridges has been introduced for use in a special grease gun. The operator, at will, may remove one cartridge and substitute a cartridge of a different kind of lubricant. Each cartridge can be used again until it is empty. This makes it unnecessary to keep on hand a number of grease guns for various lubricants.

NEW DRILL IS SHARP AT BOTH ENDS

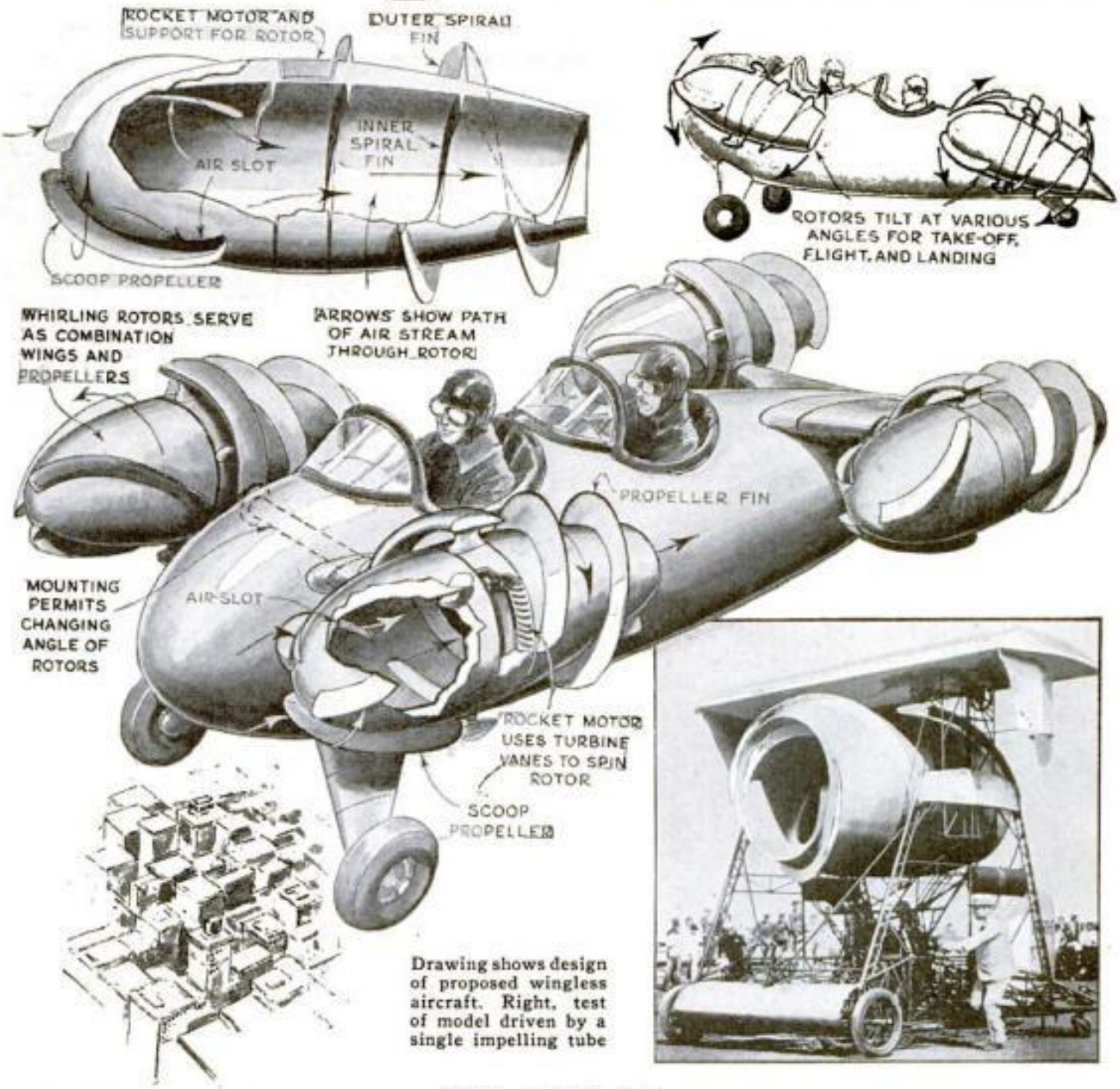
WHEN a new double-ended drill for masonry becomes dulled, a workman need only take it from the holder, turn it around, and put it back to have a new point. The idle end is protected, while the tool is in use, by a collet slipped with it into the holder. Drill and collet are readily removed by tapping the outside. Drills of the new type can be used either with hand or electric hammers.



The new drill dismantled to show its compactness. Left, the drill in use with hand hammer

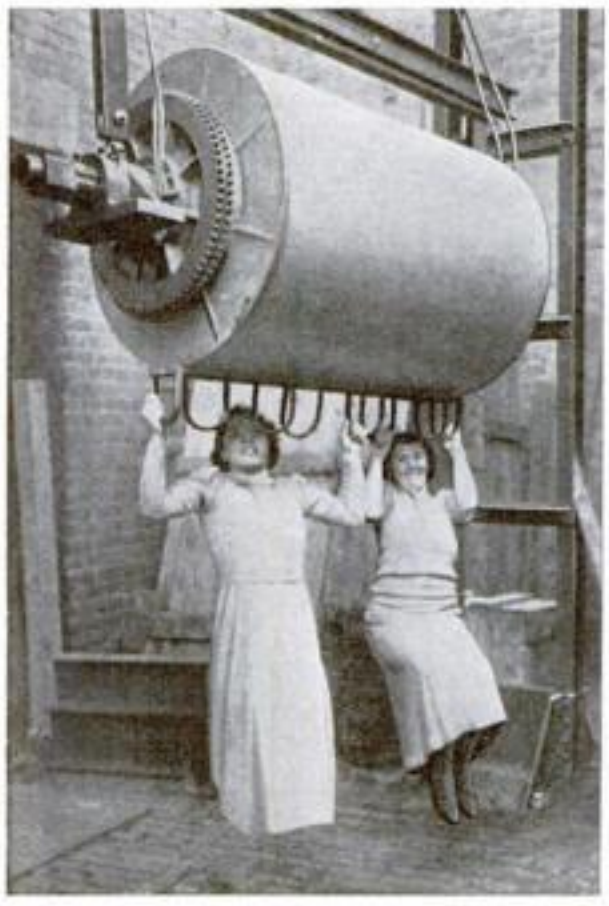
Rotors Drive Wingless Rocket Plane

TUBES ridged with spiral fins, and whirled by rocket motors, replace propellers and wings in a remarkable form of airplane proposed by Paul Maiwurm, New York inventor. His startling design is an outgrowth of tests of an earlier model employing a single tube, tried out some time ago at Mission Beach, Calif., before a throng of curious spectators. When the gyrating tube reached a speed of 180 revolutions a minute, the "barrel" plane taxied at a lively pace along the field. Although his trial craft did not leave the ground, the inventor maintained that the test satisfactorily demonstrated the advantages of his method of propulsion. Now he envisions a wingless machine employing four similar impelling tubes, which would be driven by rocketlike jets impinging on turbine blades of heat-resistant metal. The tubes would be adjustable for climbing, descending, or level flight, and could be swung to a vertical position to serve as parachutes and permit a safe landing in the event of motor failure.



Drawing shows design of proposed wingless aircraft. Right, test of model driven by a single impelling tube

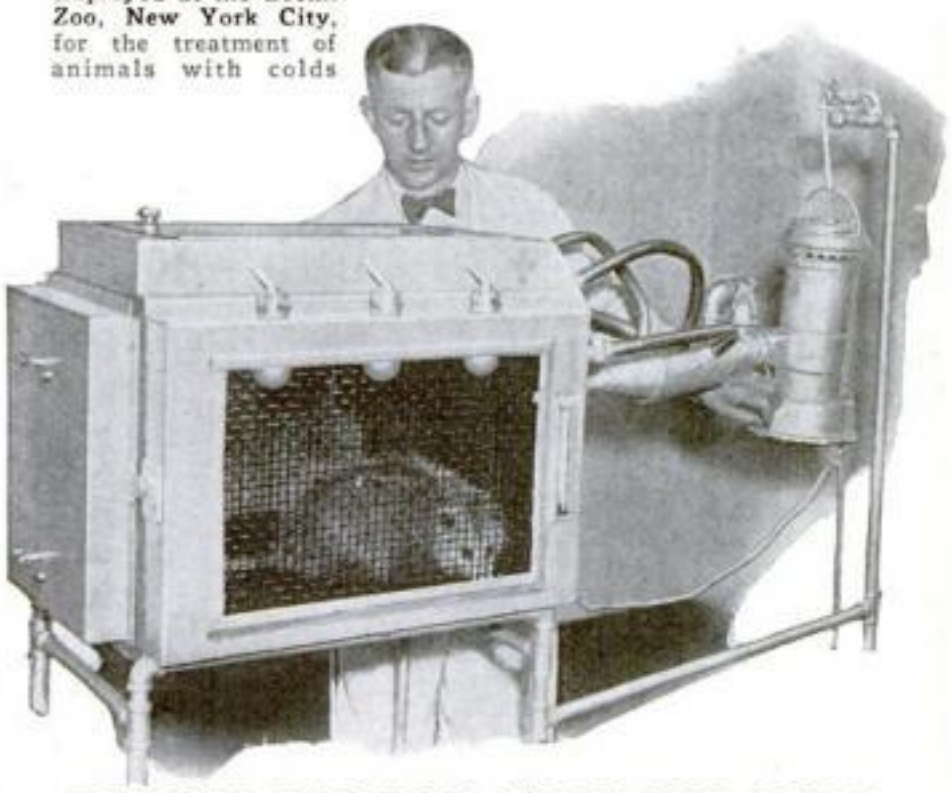
MAGNETIC DRUM AIDS IN SUGAR MAKING



A huge magnetic drum, built in England to remove iron particles from sugar in a refinery, supports the weight of two girls who swing from iron bars held by its attraction

WHAT is called the world's largest magnetic drum has just been completed for use in a beet-sugar factory at Poppleton, England. As the sugar is poured over the surface of the revolving drum, any particles of iron that it contains will be attracted by the magnet and will adhere to the surface. The great power of the magnetic drum, energized by built-in electric coils, is demonstrated in the view at left, showing two factory girls swinging from iron bars held securely in place, by the force of magnetic attraction, in spite of the pull of their weight.

Below, a novel cage employed at the Bronx Zoo, New York City, for the treatment of animals with colds



ZOO HAS CAGE FOR TREATING COLDS

WHEN animals in New York City's Bronx Zoo get the sniffles, or suffer bronchial ailments, they get first aid in a unique cage which administers three kinds of treatment separately or simultaneously—artificial heat from electric lamp bulbs, ultra-violet light from a sunshine lamp, and eucalyptus vapor. The treatments are reported to have proved beneficial to "patients," which have included a lynx club, an opossum, and a monkey.

Biggest Aerial Survey

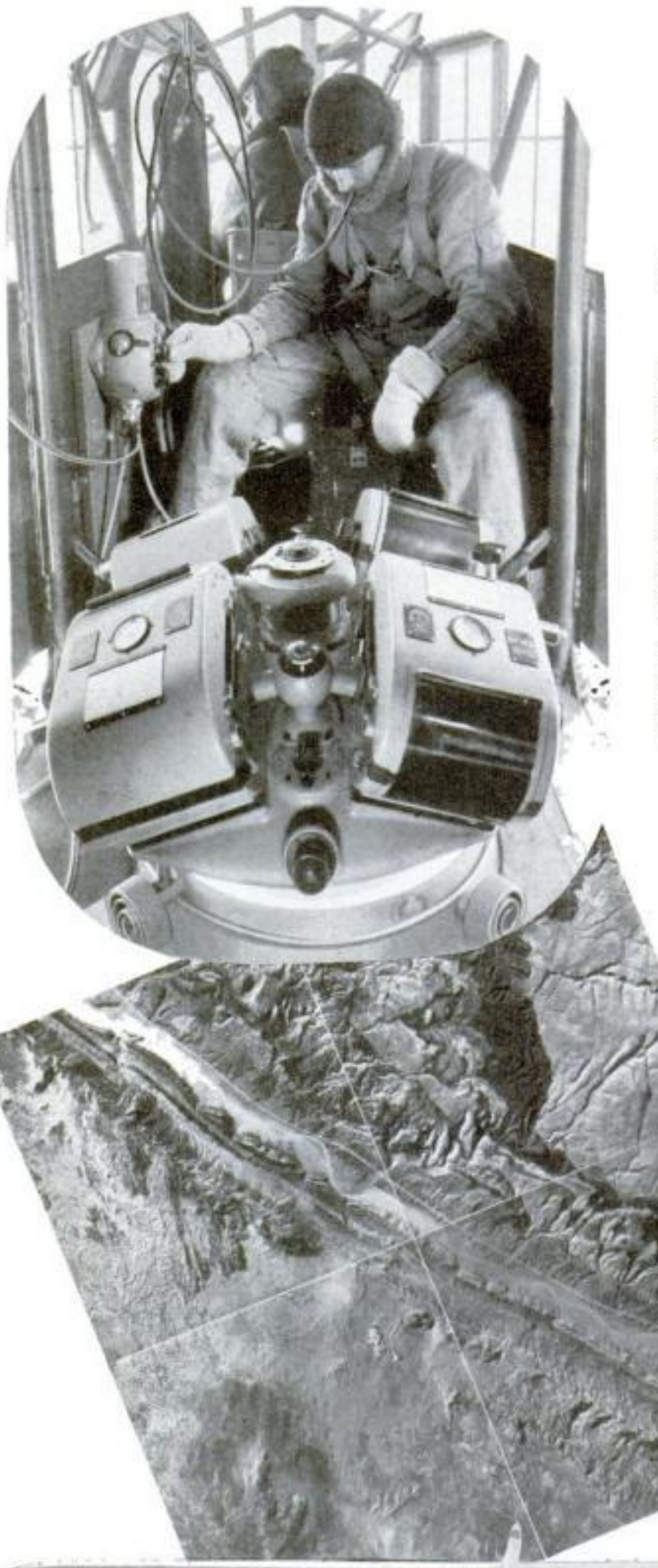
Planes Soar into High Altitudes To Get Photographs of Stricken Indian Lands That Government May Have Accurate Map

By CAPT. F. M. S. MILLER

THROUGH the eye of an aerial camera, engineers of the Soil Erosion Service of the United States Department of the Interior are planning the control of a dangerous condition that has developed in an enormous area in the Southwest. The project is the largest of its kind ever undertaken by the Government, and has required an aerial survey that not only surpasses in size any previous aerial survey within the United States, but is probably the largest precise aerial survey ever made.

The area photographed, which includes a total of 25,560 square miles, is roughly bounded on the west by a line running due north from Flagstaff, Ariz.; on the north, by the Colorado and San Juan Rivers, and on the south, by the Santa Fe Railroad with a small neck protruding south of Gallup, N. Mex., to include the Zuni Indian Reservation. East of Gallup the area narrows down into an arm which extends across the Great Divide nearly to Albuquerque.

The major portion of this area consists of the Navajo Indian Reservation. Sixty years of unregulated grazing of ever-increasing herds of sheep and goats belonging to the Navajos have resulted in a disappearance of vegetation, followed by a mass destruction of pasture lands by soil erosion. This condition of erosion has grown to such proportions that it threatens the very existence of the Navajo tribe. The sediment dumped into the rivers affects all flood-control and water-power projects in the lower San Juan and Colorado Rivers.



Left, the grotesque survey camera in use 22,000 feet up. Pilot and photographer are in high-altitude gear, taking oxygen. From the film exposed in flight, four-picture composites such as that shown below are prepared for map

When soil erosion engineers took over the huge task of controlling the devastation, they found no satisfactory maps of the area. A survey was necessary; data obtained had to be compiled on accurate maps. Accurate contour maps were also needed for the final engineering projects of erosion control. The only means of obtaining the information and maps desired, in the minimum time at a reasonable expense was an aerial survey.

Photographic mosaic quadrangles to cover the entire area were ordered with the specification that all original photographs were to conform to a common scale. Contour maps of any area were to be obtainable on demand. Thus, specifications covering the aerial survey demanded a precision that is not found in the ordinary large aerial survey.

Large aerial mapping projects, like those carried out recently in Canada, usually employ the oblique camera to record the details of the area being covered. By its use, large areas can be surveyed rapidly at little cost, and the maps produced will possess more accuracy than ground reconnaissance surveys. By a system of grids, superimposed on the photograph, the details are

Here are the crew and big Bach tri-motored survey plane. Note tank of oxygen under center motor

Aids Soil-Erosion Control

accurately transferred to maps of the area. Generally, mosaics, composed of vertical photographs, are made only for large engineering projects that require precision and cover a relatively small area.

In size, the Navajo survey was a match for the largest of the Canadian jobs, and in precision, it compared with the most accurate of the smaller projects.

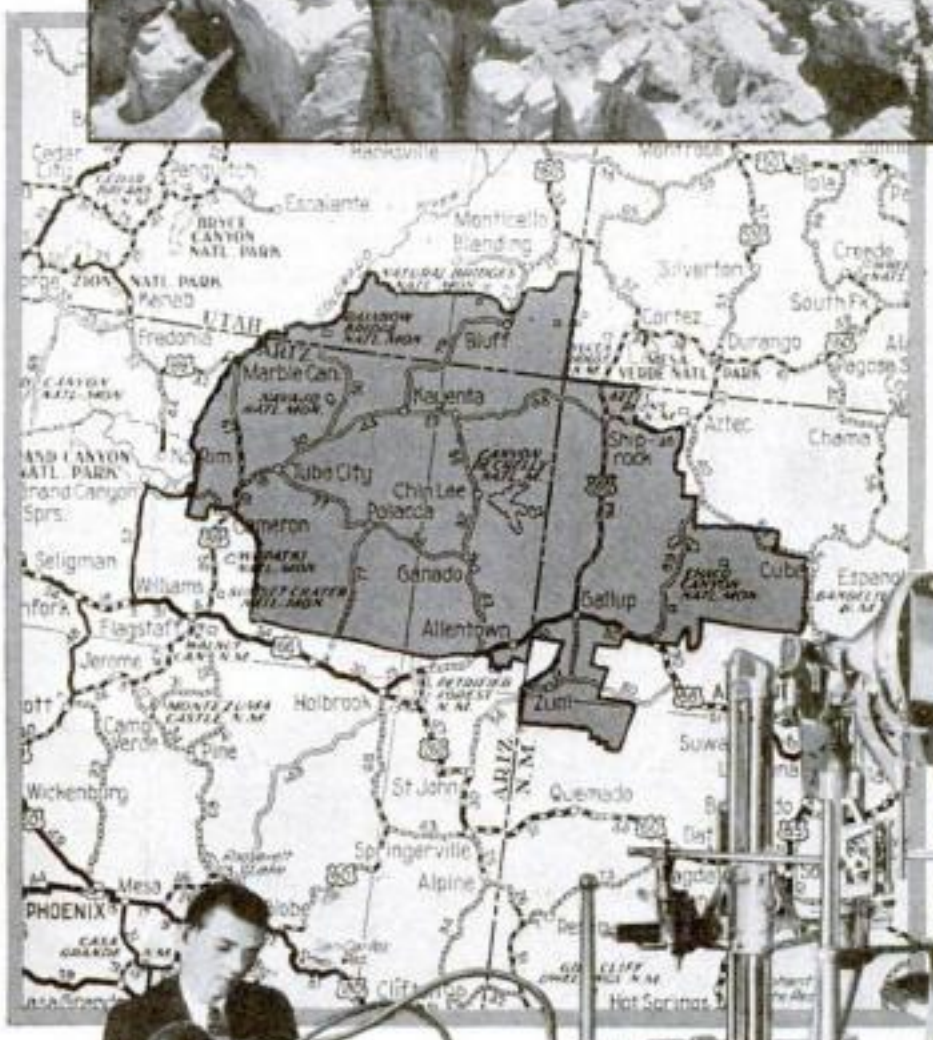
To make efficiently a precise aerial survey of an area comparable in size to the combined states of Vermont, New Hampshire and Massachusetts, was a tremendous task. Flying for the job consumed 300 hours in the air and extended over a period of six months. About eight months were spent by a ground-survey party in establishing ground-control points, and fourteen months were spent in engineering and laboratory work. Sixteen thousand lineal feet of five-and-one-half-inch topographical base film were used in taking the 30,000 pictures made during the survey and 28,000 five-by-five plates were used in the photographic processes necessary to convert the original aerial photographs into the final photographic quadrangles.

Before survey crews were sent into the field, a plan of operations was carefully formulated. A picture of the field operations was drawn on a master chart. On this chart, the immense project was broken into small working assignments for the pilot and photographer. A mosaic control system was laid out so that controls could be established for the future assembling of photographs in a single mosaic. Each working assignment consisted of a photographic strip to be shot from a given altitude during a single flight. The huge control system consisted of forty-five ground-control points established by ground survey, and five strips of aerial photographs. These strips were to be run the length of the survey, perpendicular to the strips that formed the main photographic project.

In December, 1933, Fritz Secor, pilot, and Harry Treadway, photographer, took to the air from their base at Winslow, on the first flight of the survey. Both men, flying for Fairchild Aerial Surveys, had spent more than five years in aerial survey work. They had photographed more than 50,000 square miles of ground.

Government specifications concerning the scale of all original photographs required the survey to be flown at altitudes ranging from 18,000 to 22,000 feet. A supercharged motor was required to pull the plane to these working altitudes. Cold, rare atmosphere made it necessary for the crew to use oxygen above the 10,000-foot mark and to wear heavy electrically heated fly-

The surflike ridges that appear beyond the Indian village above, are marks of dangerous erosion. Below, shaded portion of map shows the huge area photographed from the air



Far superior to methods used in ground surveys is this manner of tracing contour maps from photographs

Studying ground relief through the stereoscope, an optical device that makes details stand out as if modeled

ing suits. The delicate shutter mechanism of the camera, and the film, had to be kept from freezing by the use of an automatic heating unit in the camera.

A rugged terrain, inaccurately mapped, caused topographical errors in the scale on photographs, and made it difficult for the pilot and the photographer to identify on the ground the strips that had been blocked off on the master chart. Ten percent of the total flying time during the survey was spent in reconnaissance to familiarize the crew with the area covered by the survey as well as to locate definitely the photographic strips. Five percent of the area photographed had to be reflown to photograph ground that had been missed by the camera, and another five percent had to be rephotographed to correct topographical errors.

A ground matted with large areas of sharply contrasting colors offered a problem to the photographer. The colors caused a rapid change in extreme variations of photographic light intensity that required the use of a large variety of special lens filters. In some cases, the light intensity changed so rapidly that filters had to be changed during a flight.

The establishment of ground control points in a desolate, rugged, and practically unsurveyed territory offered many problems, but the most troublesome problems were unforeseen.

The sparsely populated, semiarid area in which the crew had to work made it necessary for them to carry water, food, and supplies to last for periods of several weeks. Hazardous climbs had to be made up precipitous cliffs and mountain sides to set up signals on the high points of buttes, small mesas and jagged mountains. The work was further hampered by dust storms, by snows and by floods following violent thunder storms.

The most annoying problem, however, was created by the superstitions of the Indians inhabiting the area. Control-point signals were constantly tampered with and had to be replaced frequently. Either their usefulness was temporarily destroyed, or they disappeared entirely. Two types of signals were used, a new type of wind-driven, rotating heliograph and a flashing beacon for night work.

Millions for Maps

The astonishing discovery that most of the United States is inadequately mapped has been made by the Government's National Resources Board. A sum of $117,531,000 must be spent to obtain much-needed knowledge of topography, to combat soil erosion. Airplane photography will be used almost exclusively. It is estimated that only twenty-six percent of the nation has been mapped satisfactorily in the light of modern engineering needs.

Heliograph reflectors were removed to adorn the boudoir walls of Navajo squaws and pieces of wire were cut from the guy supports of signals to answer needs considered important by the Indians. Several conferences were held with the natives, and strict penalties had to be threatened before the signals remained unmolested.

The flashing beacons aroused the superstitious nature of the Navajo, particularly when one of them was mounted on the top of a butte considered as a sort of monument for an Indian burial ground.

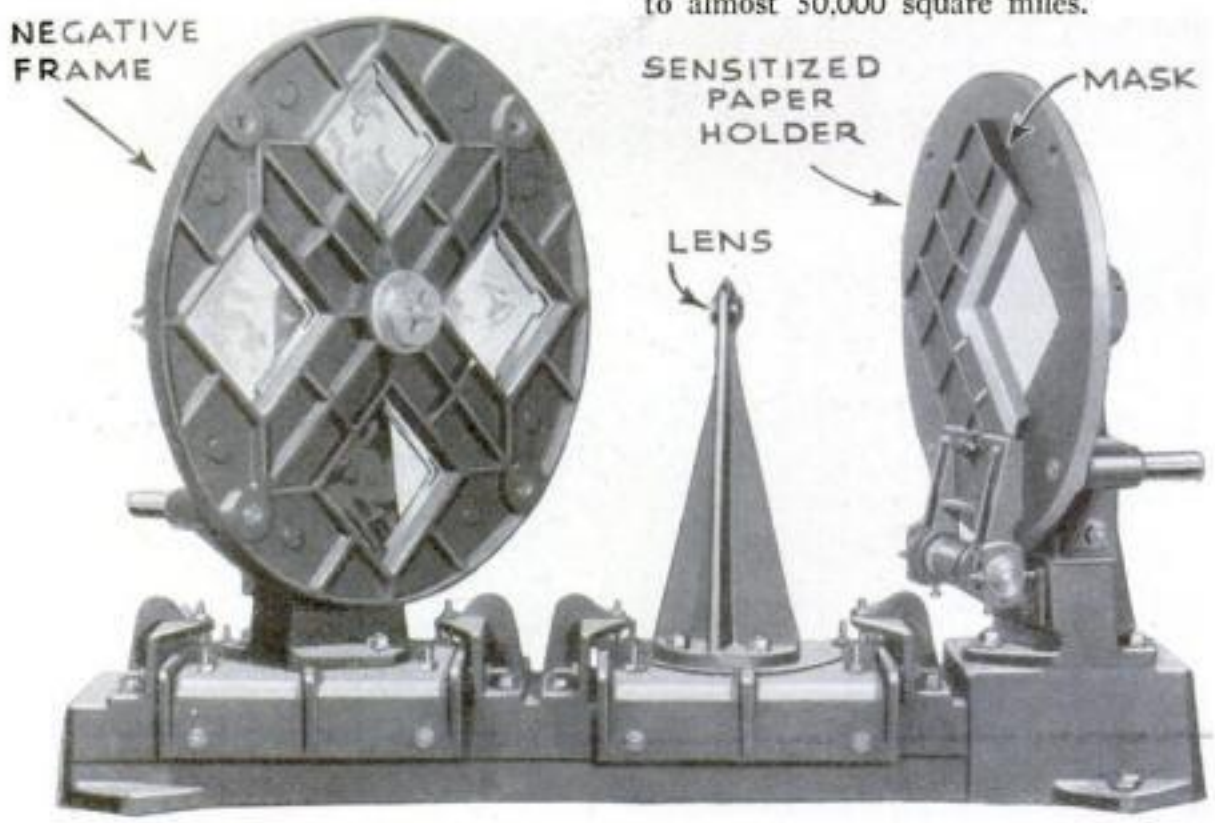
The photographic correction that was necessary to transform 30,000 pictures from the original negatives into prints from which a mosaic could be made, was a formidable task. The "photogrametric" engineers faced with the problem helped to solve it by developing a unique transforming camera.

The aerial camera used in making the survey was of a "four-couple" type that took four separate pictures at each exposure. Each of the four pictures on the negative was photographed at such an angle that a large area of ground could be completely photographed with no duplication among the parts. By the use of the new transforming camera, a single, composite picture was made of these four pictures.

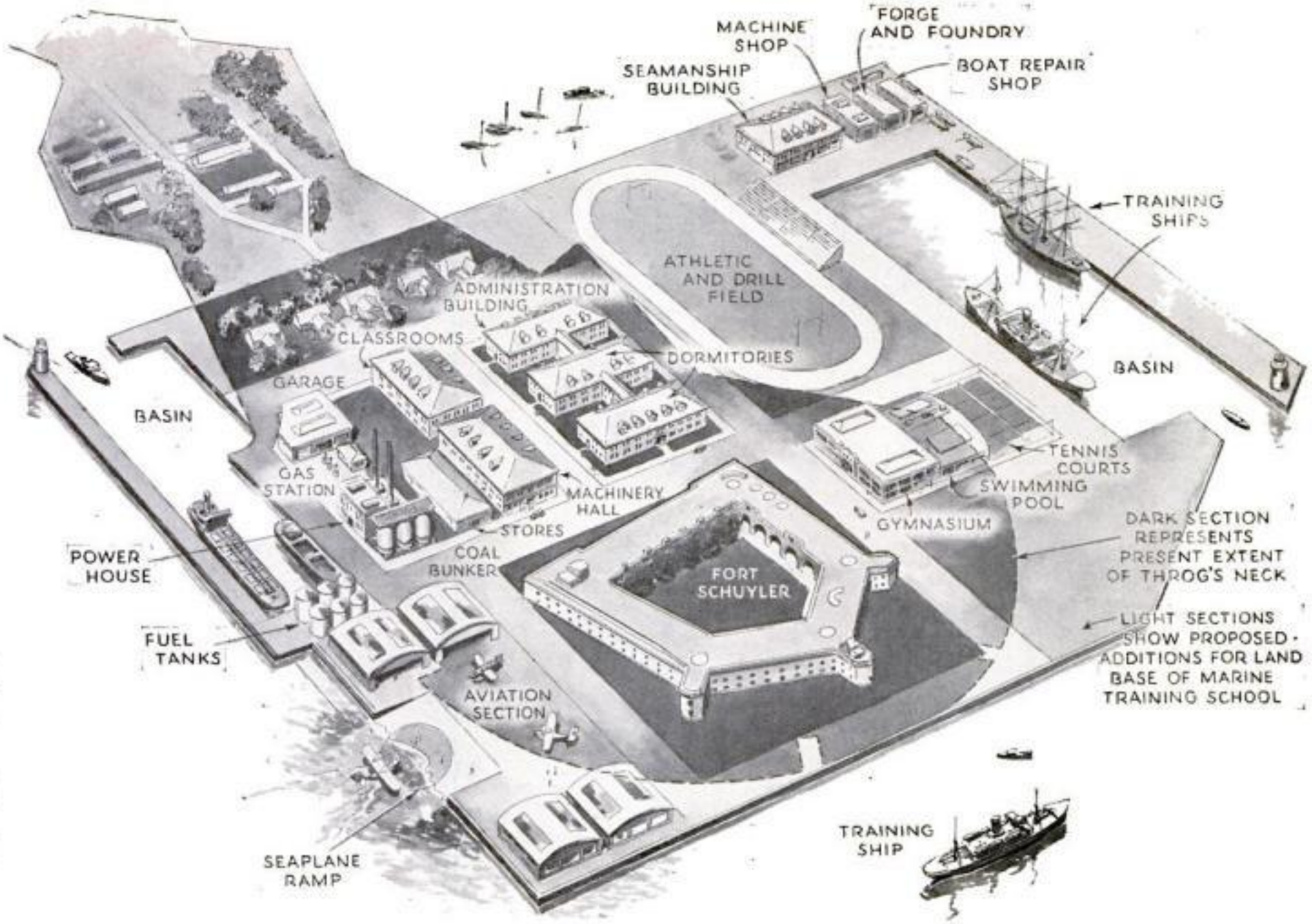
These composite pictures were then placed in the rectifying camera and corrected for camera tilt and changes in ground elevation. The resulting print was used in making up the mosaic, which was photographed into accurate fifteen-minute quadrangles with a scale of 1 to 31,680, in which two inches on the quadrange equals one mile on the ground.

The drawing of contour maps from photographs is accomplished by the aid of an apparatus known as the stereoplanigraph. The principle involved is that of the old parlor stereoscope, based on the appearance of relief given when two pictures of the same object, taken at slightly different angles, are brought together through the lenses of the apparatus. All photographs made during the survey were taken with an overlap of sixty percent with adjacent photographs; this method allowed any two adjacent pictures to be used in making a contour of the area.

A gigantic job has just been completed, but a new project, nearly as large as the Navajo Survey, has begun. The new survey includes the 24,000 square miles of the watershed of the Gila and San Pedro Rivers in Southern Arizona and New Mexico. It will bring the total area to be mapped for the purpose of soil erosion control, within a span of two years, to almost 50,000 square miles.



HOW MAP PHOTOGRAPHS ARE PRINTED. The disk at the left revolves. It holds four negatives. Each is printed singly, and the disk at right given one quarter turn each time. Blended lights that project each picture through the lens, center, tint final print evenly

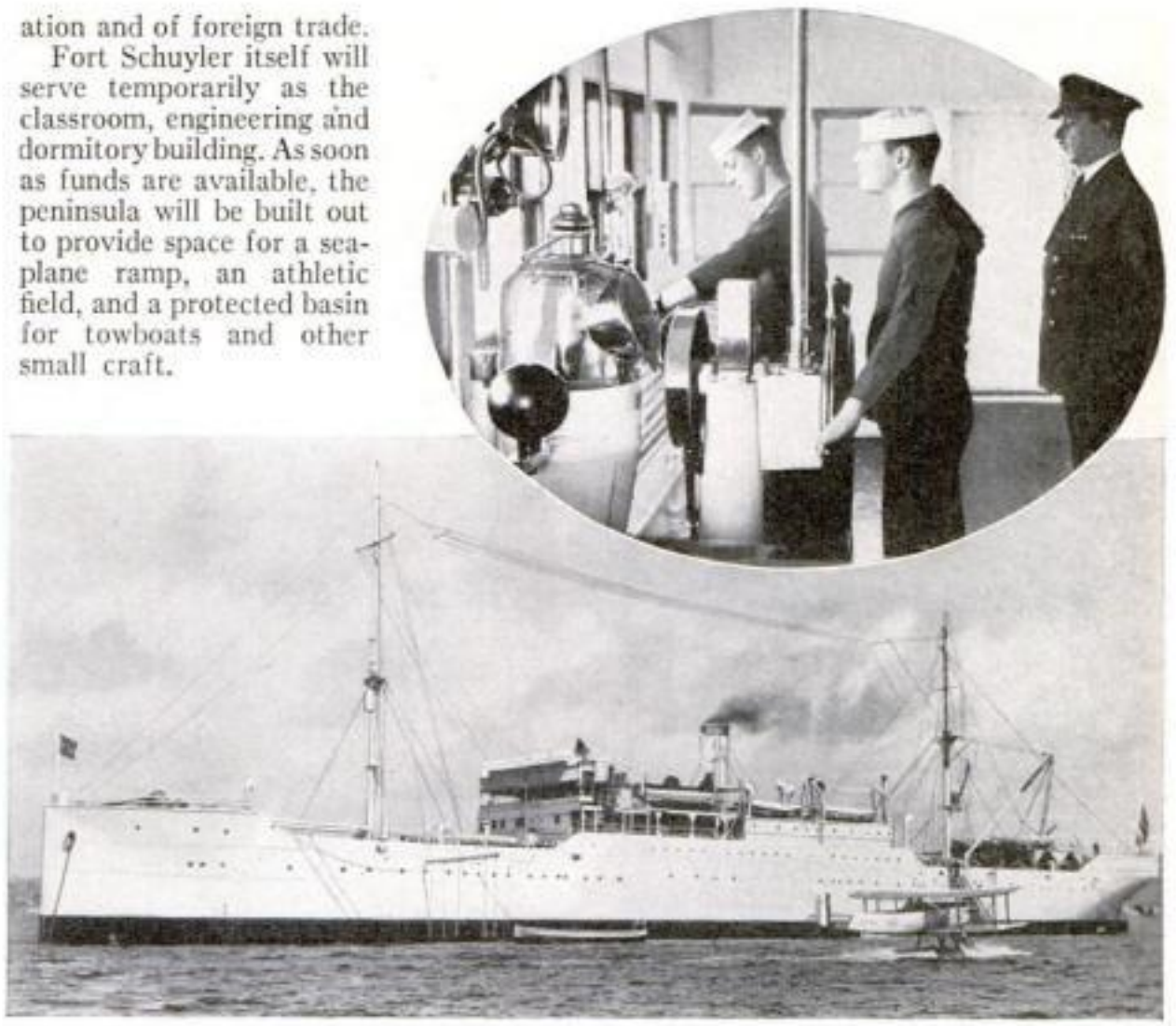


New School To Train Ships' Officers

AMERICA'S first "University of the Merchant Marine"—a college ashore for would-be mariners—is soon to become reality, as a result of a recent grant of twenty acres of land of the old Fort Schuyler reservation at Throg's Neck, N. Y., by the War Department, and a $500,000 grant from the Federal Emergency Relief Administration. Here boys from seventeen to twenty-one may learn to be mates and engineers; there will be special courses for unlicensed officers, and also correspondence courses in navigation, law, engineering, and ship's business, for men who are already employed on vessels.

Formerly, seamen and seagoing engineers have been trained for American ships by the New York State Merchant Marine Academy on training ships furnished by the Navy Department. The new marine university planned by the New York school, however, will offer additional instruction never before available. It will provide a training base for ship-to-shore flyers, practice courses for lifeboat drill, and fully equipped classrooms for ships' engineers and deck officers. There will be physics and chemistry laboratories, machine shops and engineering halls, and ship machinery and navigating instruments of every type. Besides such technical subjects, the university will teach foreign languages, mathematics, maritime law, insurance, and the economics of ship operation and of foreign trade.

Fort Schuyler itself will serve temporarily as the classroom, engineering and dormitory building. As soon as funds are available, the peninsula will be built out to provide space for a seaplane ramp, an athletic field, and a protected basin for towboats and other small craft.



The U.S.S. *Empire State*, training ship of the New York State Merchant Marine Academy. In oval, cadets learn navigation and steering by actual practice under a licensed officer

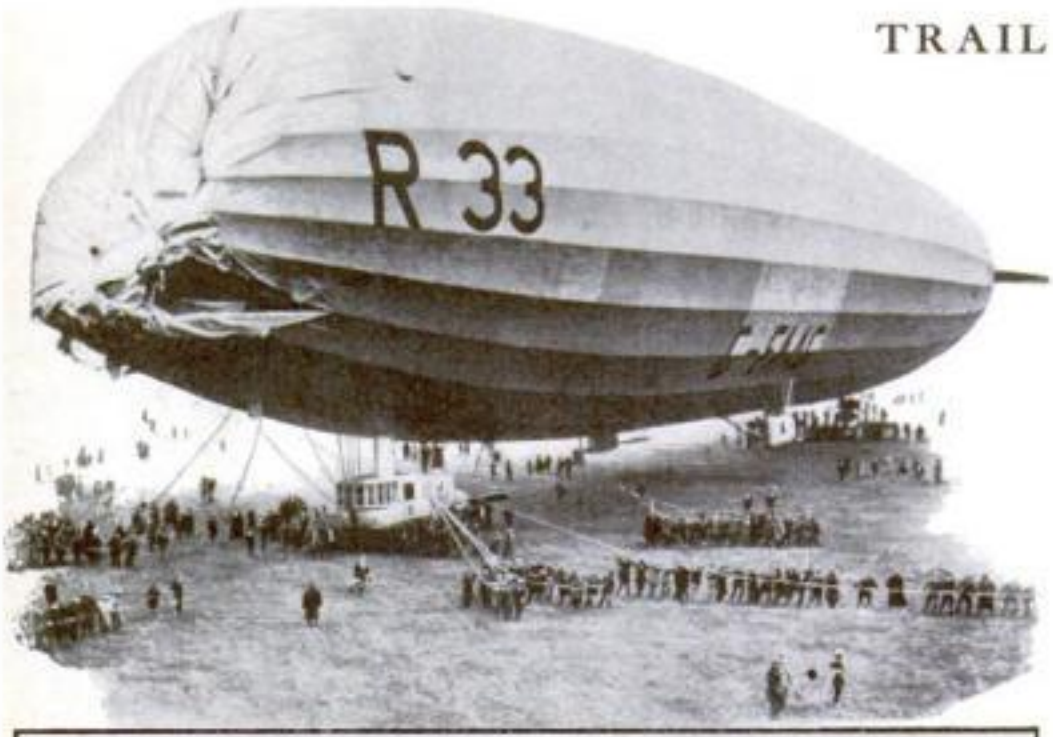
WHEN THE DIRIGIBLE WAS YOUNG

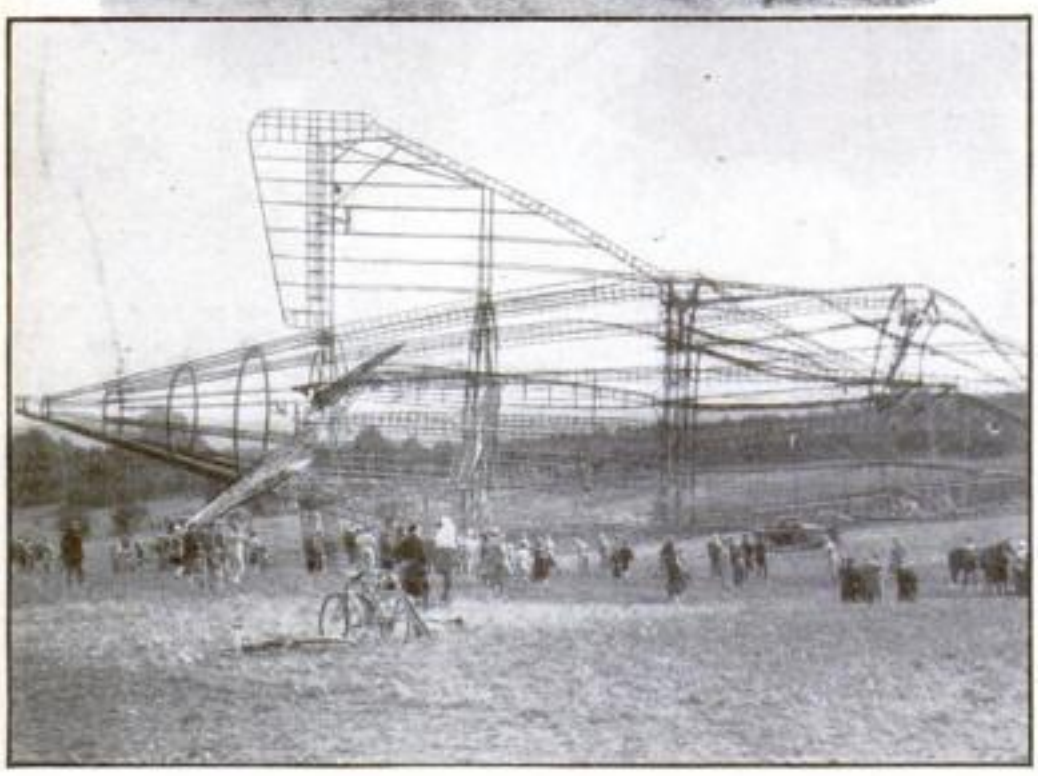
The LZ-4, one of the early Zeppelins, in the air during a trial flight. The patch on the nose of the craft is a temporary repair made after the ship was damaged slightly in striking a tree. The LZ-4 later exploded in mid-air

By Edwin Teale

Does Latest Disaster Spell

TRAIL OF DEATH MARKS HISTORY





FATE EVER PURSUES THE LEVIATHANS OF THE AIR

The middle picture shows the R-33, one of two dirigibles built in England during the World War, making a safe landing after a near-disaster in the air. Above, the wreck of the R-101, which figured in one of the most tragic episodes in the history of the dirigible. The palatial British craft, intended for service between England and India, crashed into a hillside in France, and burned, with a loss of forty-nine lives

THIRTEEN miles west of the jutting rocks of Point Sur, Calif., eighty-one men, tossing on rubber life rafts, watched an immense silver cone sink slowly into the sea.

It was the nose of the *Macon,* the United States Navy's $2,600,000 airship—biggest in the world—slipping backwards into 250 fathoms of water. For forty minutes, the men had endured a nightmare in the sky. With gas cells collapsing, framework breaking up, and controls out of order, the great dirigible had reared and plunged and finally had fallen 3,000 feet into the Pacific.

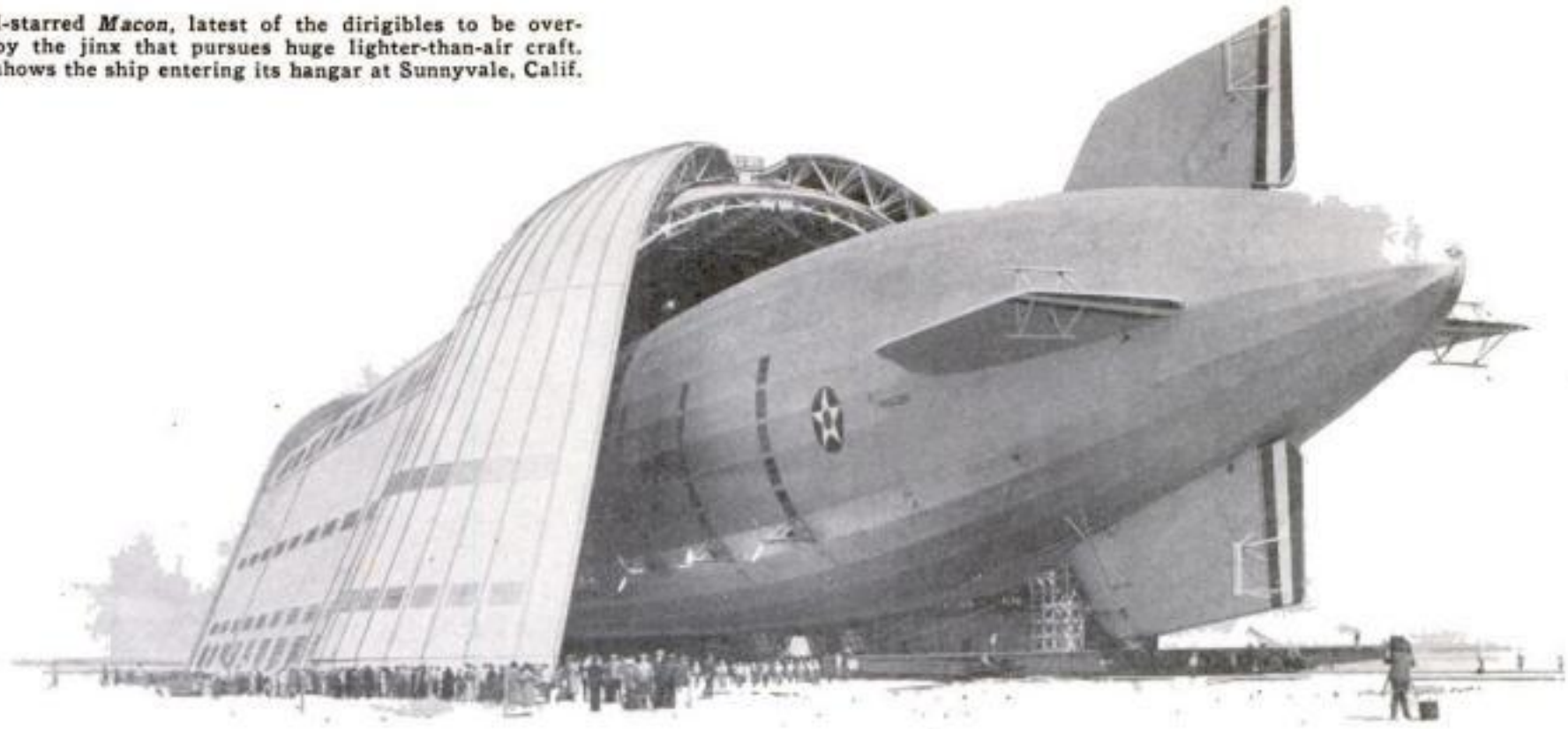
An hour later, fighting ships, guided by red rockets shot up from the rafts, were sweeping their searchlights over the spot, rescuing survivors. All but two of the eighty-three men aboard the ill-fated craft were saved. Preparation, discipline and the nearness of the warships, with which the *Macon* had been carrying out maneuvers, prevented greater loss of life.

When the men on the rafts watched the *Macon* drop beneath the waves, they also saw disappear present hopes for American supremacy in the realm of super-dirigibles. Twenty-two months before, almost to the day, the *Akron,* sister ship of the *Macon,* had crashed into the Atlantic twenty miles off Barnegat Light on the New Jersey coast, carrying all but three of its passengers to death. One of the survivors was Lt. Comdr. Herbert V. Wiley, the skipper of the *Macon* who escaped again in the wreck off Point Sur. And, just ten years before, the first American-built rigid dirigible, the *Shenandoah,* was caught in a line squall over Ohio, broken like a straw, and scattered in wreckage over the countryside. Fifteen men were killed.

With the Atlantic claiming the *Akron,* the Pacific the *Macon,* and the Middle West the *Shenandoah,* all of America's fighting dirigibles have disappeared. Only the *Los Angeles,* condemned as structurally unsound and employed for experiments alone, remains at Lakehurst, N. J. Of more than 130 rigid dirigibles which have been built, only one, the famous *Graf Zeppelin* with the veteran Dr. Hugo Eckener in command, remains in the sky.

Why have these aerial giants, one after another, crashed and disappeared? Are the crews to blame? Are the ships inherently unfit to battle the elements? Are the stresses and strains of the shifting air currents greater than designers have calculated? And finally, with the crash of the *Macon,* has the rigid-type dirigible—costly

The ill-starred *Macon*, latest of the dirigibles to be overtaken by the jinx that pursues huge lighter-than-air craft. Photo shows the ship entering its hangar at Sunnyvale, Calif.



the Doom of the DIRIGIBLE?

OF LIGHTER-THAN-AIR CRAFT

and easily damaged—come to the end of its tragic road?

The answer may lie in a bird's-eye view of that road.

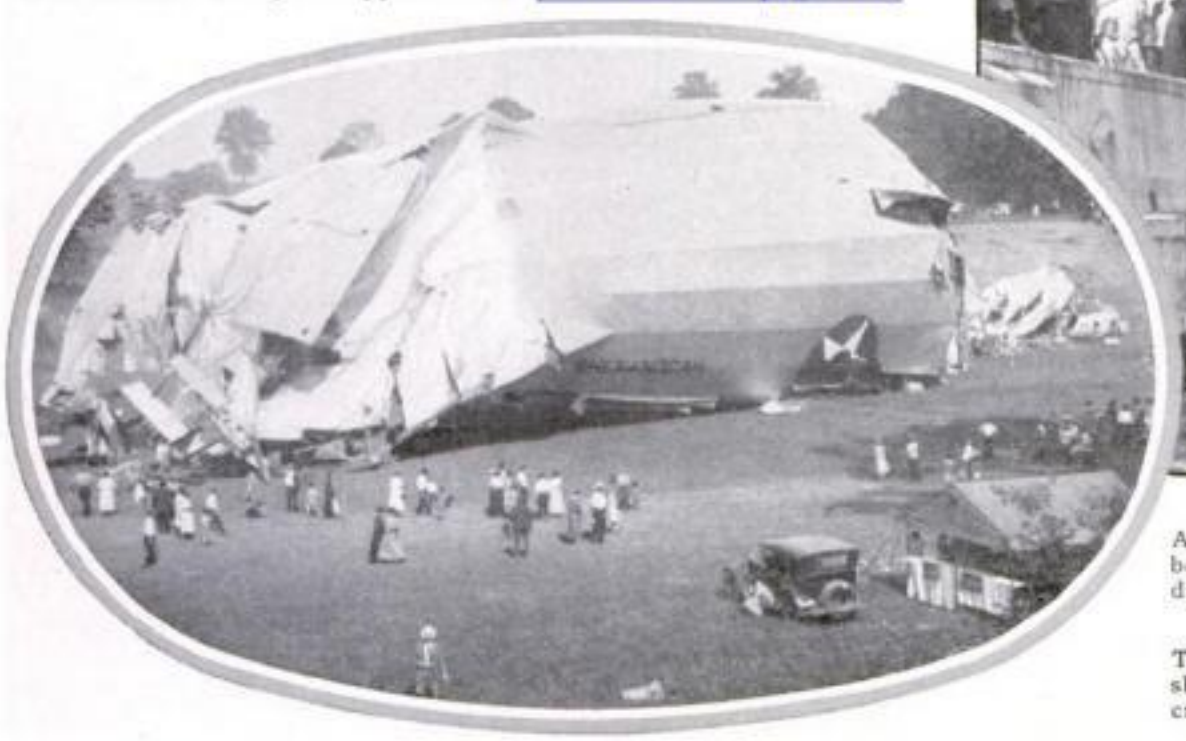
It starts at a strange floating hangar, a giant shed anchored on the waters of Lake Constance at the German-Swiss border. The time is the first year of the present century. Count Ferdinand von Zeppelin, a retired army officer, fifty-six years old, has organized a company to build a leviathan of the sky, a dirigible 420 feet long with sixteen rubberized-fabric gas cells and a framework of aluminum.

Zeppelin had made his first flight in a balloon at St. Paul, Minn., while an observer with the United States Army during the Civil War. Later, he worked out plans for his revolutionary airship and in 1889 presented them to the King of Württemberg in the hope of obtaining a grant of funds. Disappointed, he organized a company nine years later and started work at Friedrichshafen on the shores of Lake Constance, where he was born.

The ship he built cost $238,000 and held 400,000 cubic feet of hydrogen. It was completed in the spring of 1900 and transferred to the floating shed for tests. On the first trial, a sliding weight which was used to balance the craft stuck, the dirigible sagged in the middle like a sway-backed horse, and in the rapid descent it ripped its envelope on a piling.

In later tests, it soared aloft, maneuvered in all directions, and landed safely. Zeppelin was *(Continued on page 114)*

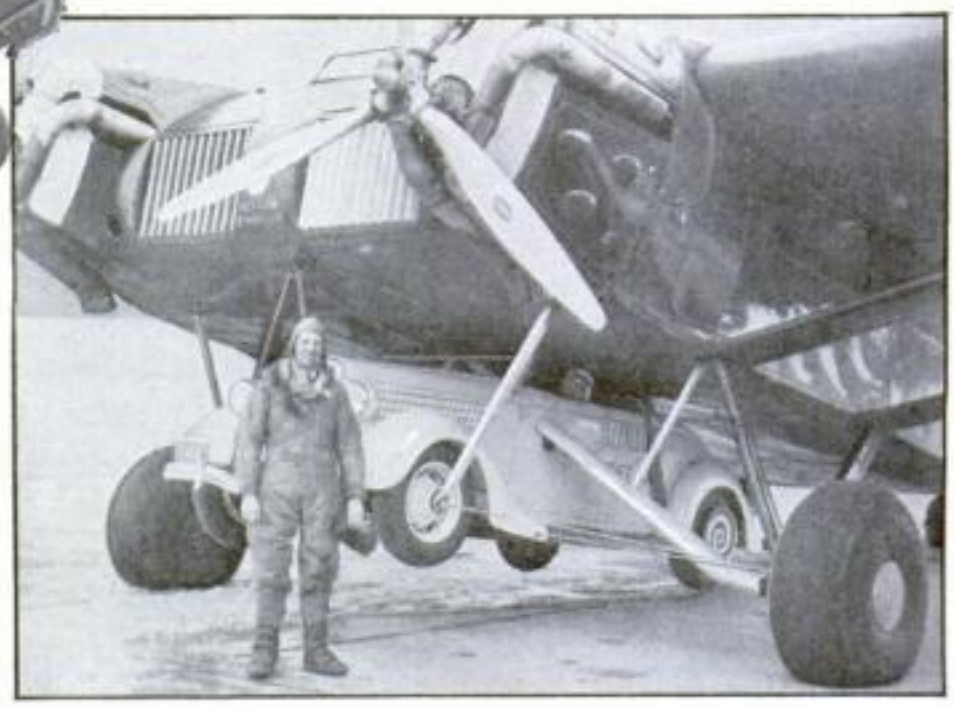
Above, the huge port fin of the U. S. Navy dirigible *Akron* being removed from the ocean off the New Jersey coast. The disaster in April, 1933, cost the lives of seventy-three men



The wreck of the *Shenandoah*, first of the U. S. Navy airships to meet disaster. Caught in a squall over Ohio, the craft crashed to earth, carrying fifteen men to their death

Auto Soars with Plane in Fuel Test

Transport plane in flight with automobile for cold-weather oil test. Below, photo shows how car was suspended beneath the body of the plane



A CAR took one of the strangest of rides, not long ago, when it flew for ninety minutes over Floyd Bennett Field, N. Y., suspended beneath a huge transport plane. The odd test, which included starting the car's motor in mid-air, was undertaken to demonstrate the responsiveness in cold weather of a motor fuel. According to the participants, it also foreshadowed the use of airplanes to whisk ambulances to stricken communities, armored cars to battlefields, and rescue launches to sinking ships. While the unaccustomed air drag slowed the plane and tended to nose it down, the pilot reported no serious difficulty in handling it.

NOVEL WINDMILL USES SPIRAL-SHAPED VANE

A VANE curved in a spiral shape provides the motive force for a "rotor windmill" proposed by a Brooklyn, N. Y., inventor as a source of power. Air entering the scoop-shaped opening exerts a driving force that turns the rotor, subsequently escaping through apertures at the ends. Several of the rotors could be mounted in combination, either horizontally or perpendicularly, for generating electricity, according to the inventor, who is shown above with a model of his unusual device.

STATUES MOLDED IN SYNTHETIC RESIN

FROM an illuminating gas and a poison gas, the magic wand of the chemist has produced a synthetic resin whose versatile usefulness has amazed even its creators. The new substance, known by the formidable name of a "polymerized vinyl chloride," is normally a hard, horn-like material, but ways have been found to make it as plastic as jelly or as tough and flexible as rubber. One unexpected application is in making casts of architectural details and statues, as shown; the substance is applied as a warm jelly and hardens on cooling to give a flexible, yet accurate mold for a plaster cast.

Mold made of new synthetic substance for making a plaster cast. The process is used in producing casts of architectural details

CAMP COOKER ENDS FIRE PERIL

AN OUTDOOR cooker that may be used in a back yard without harming a lawn, or in the woods without fear of starting a forest fire, has been produced by a California inventor. Wood or charcoal serves as the fuel, and ashes drop into a cone at the bottom for ready removal. The sides of the funnel-shaped cooker, which is shown in use in the illustration at the right, are perforated in order to provide a suitable draft for the fire.

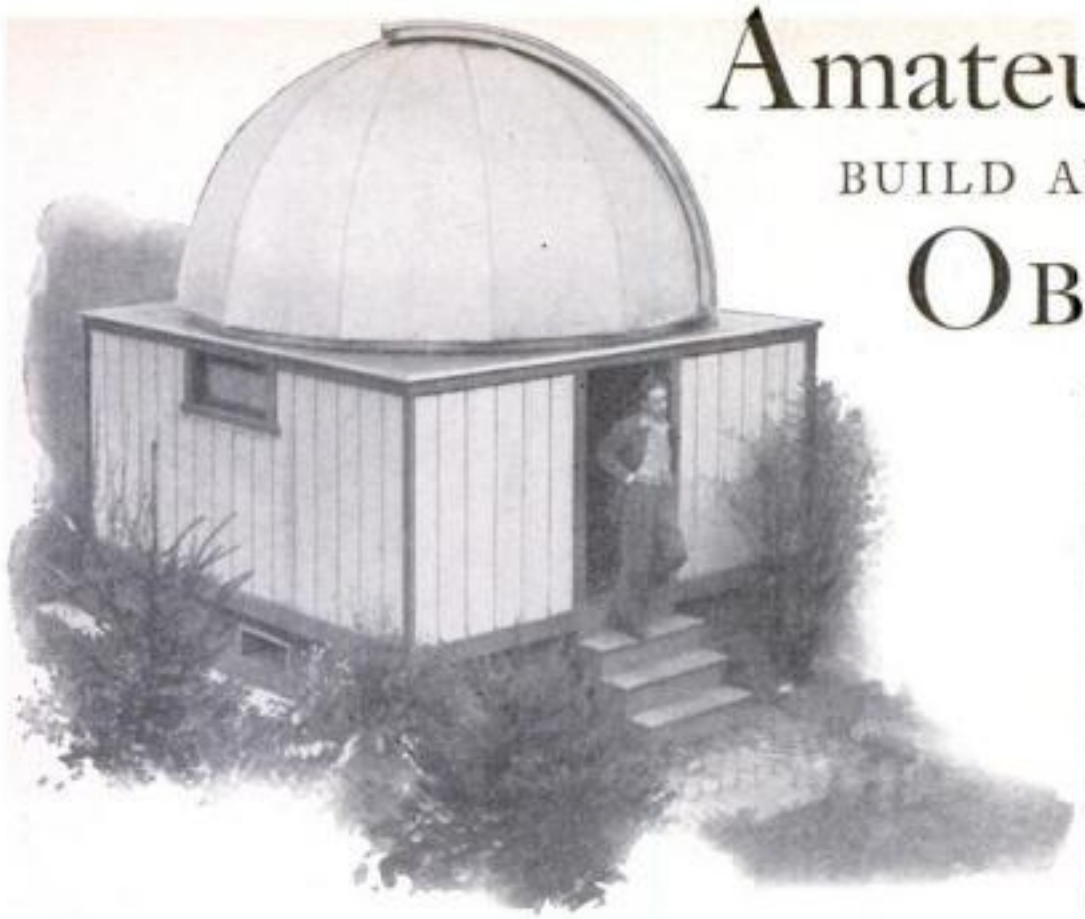
NEW SAFETY DART HAS RUBBER SUCTION TIP

THROWING darts is made a safe indoor sport by a new form of missile, in which a rubber suction cup replaces the needle point of the older type. When a dart is thrown from the hand at a target, it clings wherever it strikes, as shown in the photograph. A numbered score board may be used as the target, and a white indicator attached to the base of each dart points to the score that has been made by the person throwing it.

Amateur Astronomers

BUILD AND EQUIP THEIR OWN

OBSERVATORY



The Valley View observatory, built by members of the Astronomical Section of the Pittsburgh Academy of Science and Art. It stands on a hilltop near the city

Leo J. Scanlon, chairman of the committee that arranged the exhibit of the Pittsburgh amateur group, discussing meteorites with Mrs. Maude S. Wiegel, another member. Mrs. Wiegel, a farmer's wife, distinguished herself in observing sun spots

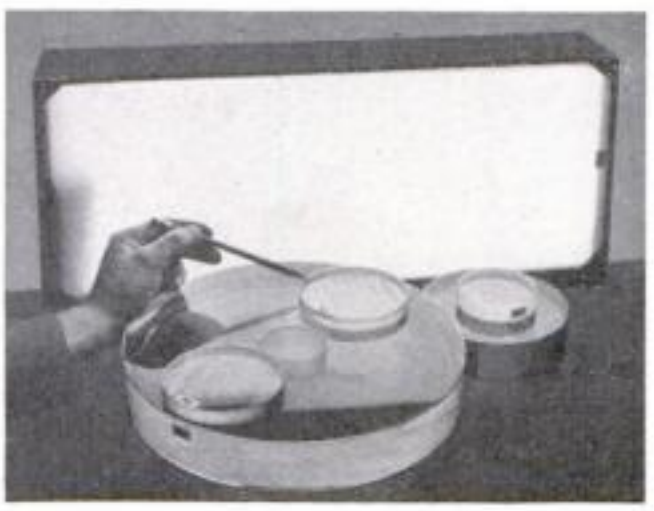
WHEN a new comet is discovered, or important observations are made on the twinkling of a variable star, it is not always the work of professional astronomers. Often the credit belongs to one of the country's 2,000 or more amateurs who are constantly sweeping the heavens with homemade telescopes. Not long ago some of them demonstrated their handiwork at an exhibition held by the Astronomical Section of the Pittsburgh Academy of Science and Art—the largest association of amateur astronomers in the world—and revealed how this organization came into being.

Seven Pittsburgh, Pa., men, who enjoyed spending their leisure hours in grinding and polishing lenses for homemade telescopes, got together four years ago. They helped each other make telescopes, and discovered a suburban hilltop where the "seeing" was excellent for setting up their instruments. Before long, the membership had tripled. Then the members decided to erect a real observatory. They built and installed a ten-inch reflecting telescope with magnification ranging from fifty to 750 power. They opened their observatory to the public twice a week, and 1,500 visitors came within a year.

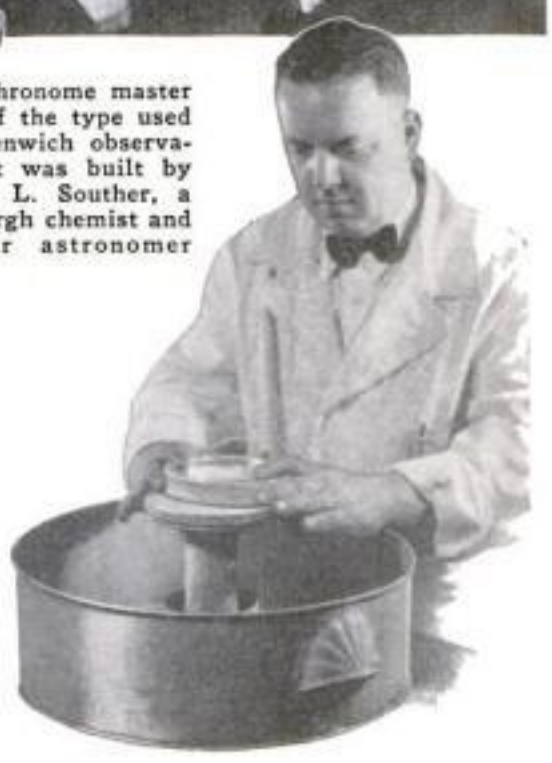
Today the organization numbers 125 members. It includes railroad officials, plumbers, ministers, mathematicians, lathe workers, retired bankers, high school boys, a Benedictine nun, and a farmer's wife. Sixty-five of the members have built their own telescopes, and most of the others have instruments under construction.

Telescope building is a relatively inexpensive hobby, the amateurs have found.

An eight-inch portable reflecting telescope built by two of the members of the club in the machine shop of the observatory. The proud builders are beside it



Left, optical flats ground to accuracy of one half wave length by Valley Viewmembers. They were shown at the recent exhibit. At right, Lawrence G. Scanlon demonstrates the grinding of a six-inch telescope lens for the benefit of visitors to the exhibition



A synchronome master clock of the type used at Greenwich observatory. It was built by Dr. B. L. Souther, a Pittsburgh chemist and amateur astronomer

are- evil obbyist RUNS OWN WILD ANIMAL IRCUS

JUST BEFORE THE SHOW BEGINS

With whips that have long lashes so that they can be snapped loudly as the wild animals do their tricks, the young trainer, his wife, and a zoo keeper are shown in front of the cage of a lion

By A. Morton Smith

RISKING his life in the pursuit of an unusual but exciting hobby is a common experience for Frank J. Walter, Jr., wealthy young sportsman of Houston, Tex. Walter's pastime is teaching tricks to wild animals. His menagerie includes lions, bears, monkeys, wolves, an elk, and a zebu. He also trains such domestic animals as horses, mules, goats, and dogs.

Walter bears many scars resulting from encounters with unruly pets, but these experiences have not detracted from his enthusiasm for his hobby. His wife, who had not even ridden a horse before their marriage five years ago, now puts performing horses through their feats with all the skill of a circus woman.

During the last fourteen years, Walter has trained more than two score wild and domestic animals simply for the pleasure he finds in the activity, and has developed at least two outstanding feats that are not duplicated in the professional show world.

He fights and wrestles with Congo, his four-year-old African lioness. "It is not unusual to find a lion that has been taught to fight or wrestle with its trainer," he says, "but Congo is the only one I have ever heard of which does both." And Walter's paint pony, Cherokee, holds the world record (110 feet) for distance walking on its hind legs.

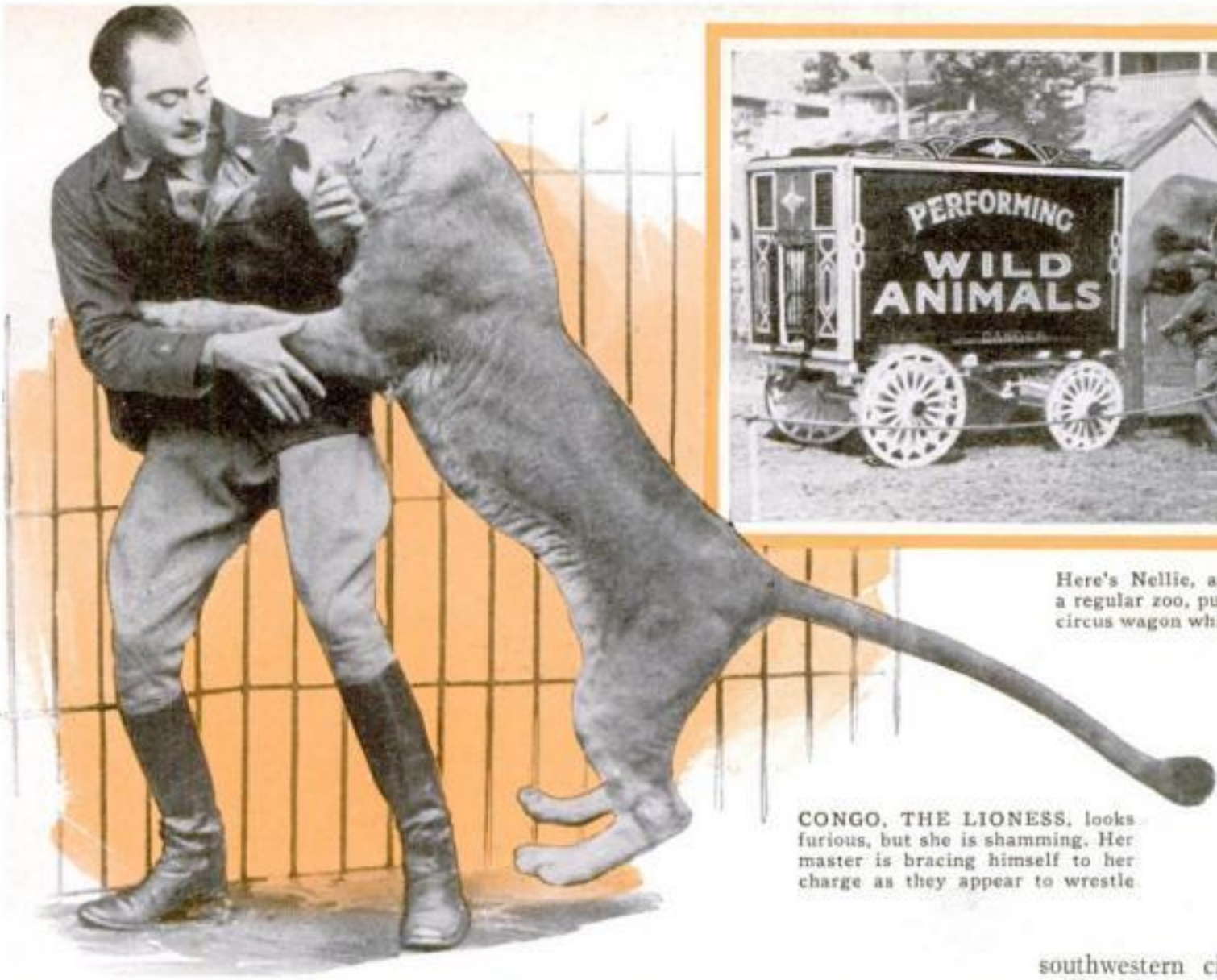
Training of the fighting lion was Walter's most arduous and exacting experiment, which began when the animal was a tiny cub and has been continued without interruption. At first, Walter merely taught her to leap from one pedestal to another, to roll a barrel, and to jump through a hoop,—routine tricks for wild animals. After that, six months were required to teach the lioness the fighting and wrestling act.

"To accomplish this feat," Walter says, "it is necessary to have a lion with a good disposition and above all things a level head—capable of understanding commands and acting immediately when addressed. The lion must know that it is required to release any hold that it may have when I say 'No.' In the early training of Congo, I saw that she would mind me."

Walter enters the arena with the lion, the stage set with but a single high pedestal in the center of the cage. He carries a long lash whip in his right hand and a short sulky whip in the left. The lash whip is cracked frequently to emphasize cues. The short whip is for protection—to ward off an attack if need be.

Feigning stubbornness, the lion refuses to mount its pedestal and the trainer follows it around the ring, cracking his whip. At each command, the lion roars, bares its fangs and strikes out with a paw. The fight continues as long as it holds the interest of the audience and the lion is then allowed to mount the pedestal. Walter steps back several feet, braces himself for the lion's charge, and throws down

IT'S A FAMILY AFFAIR. Mrs. Walter, who had never even ridden a horse before her marriage five years ago, puts a pinto pony through his paces before admiring spectators



Here's Nellie, an elephant borrowed from a regular zoo, pushing a brightly decorated circus wagon which the trainer himself built

CONGO, THE LIONESS, looks furious, but she is shamming. Her master is bracing himself to her charge as they appear to wrestle

Wrestling with Lions and Wolves in His Private Menagerie Is This Young Texas Sportsman's Idea of Fun and Recreation

his whips, the cue for the lion to leap from the pedestal to the trainer's shoulders.

Man and beast roll about the arena in a close embrace, the lion snarling and slashing at its master. Walter apparently emerges triumphant from a "death" struggle and the lion is driven through the chutes to its den. Throughout the combat, the lion's strict obedience is strikingly evidenced as softly spoken commands cause the beast to move quickly and release holds to avoid injuring the trainer.

Despite the fact that the act has been performed dozens of times, Walter has been seriously hurt only once. That was when the feat was being filmed for a news reel and at the request of the cameraman, a portion of the turn was repeated.

"That was almost a fatal mistake," Walter explains. "Every animal trainer knows that a beast must be required to go through the full routine of its act every time it is performed or there will be trouble. The animal will either seek to avoid some particular trick which it does not like to do, or make some unexpected move that may prove disastrous to the trainer. Accordingly, when I attempted to put Congo through her wrestling act without leading up to the scuffle with the usual routine of tricks, I was in for it."

The animal grabbed Walter's right arm in its mouth and sank its fangs into the flesh, paralyzing a nerve. For four days the limb was completely paralyzed, and although the incident occurred more than a year ago, the trainer has not fully regained use of the arm.

Cherokee, the horse trained for long-distance walking on its hind legs, was merely a good saddle horse when Walter bought it. The animal is one of six horses in the Walter stables. Three of them are trained to work together in a military drill, running in a circle, waltzing, lying down, sitting up, and mounting pedestals at the spoken commands of Mrs. Walter, who specializes in the horse acts. She also rides a five-gaited mare, and has received awards in several horse shows in Houston and other southwestern cities, as an equestrienne.

Since he was ten years old, Walter has loved animals. At that tender age, he trained a timber wolf to wrestle with him and perform other stunts, and he has since owned seven wolves. While still in his teens, he trained a bear cub, and at eighteen, he spent much of his leisure time at the Herrmann Park zoo, near his home in Houston. Hans Nagel, the zoo keeper, permitted him to assist in caring for the birds and beasts on Saturdays and holidays, and in exchange for his services, taught the lad the first principles of caring for and training animals.

While watching a newspaper photographer taking a picture of an outlaw lion which had been bought by the zoo from a circus twelve years ago, Walter suggested that the bars of the cage would obstruct the view of the beast. Friendly banter that followed, led the young man to volunteer to go into the cage with the camera and take the picture.

"It happened that the lion wasn't tough that day", he recalled. "He was quiet and docile. That gave me confidence and I have been on intimate terms with wild animals ever since. That trip into the outlaw lion's cage really started my hobby for training animals."

One of the most hazardous training tasks which the Texan has undertaken was the breaking of two elk as a tandem team to pull a sleigh, just before the Christmas season two years ago. He had purchased five of the animals from a dealer in North Dakota and selected two for his team. His first

(Continued on page 108)

A jungle-bred leopard is shown in a thrilling leap over the crouching dare-devil

How Railroad Time-Tables Are Made

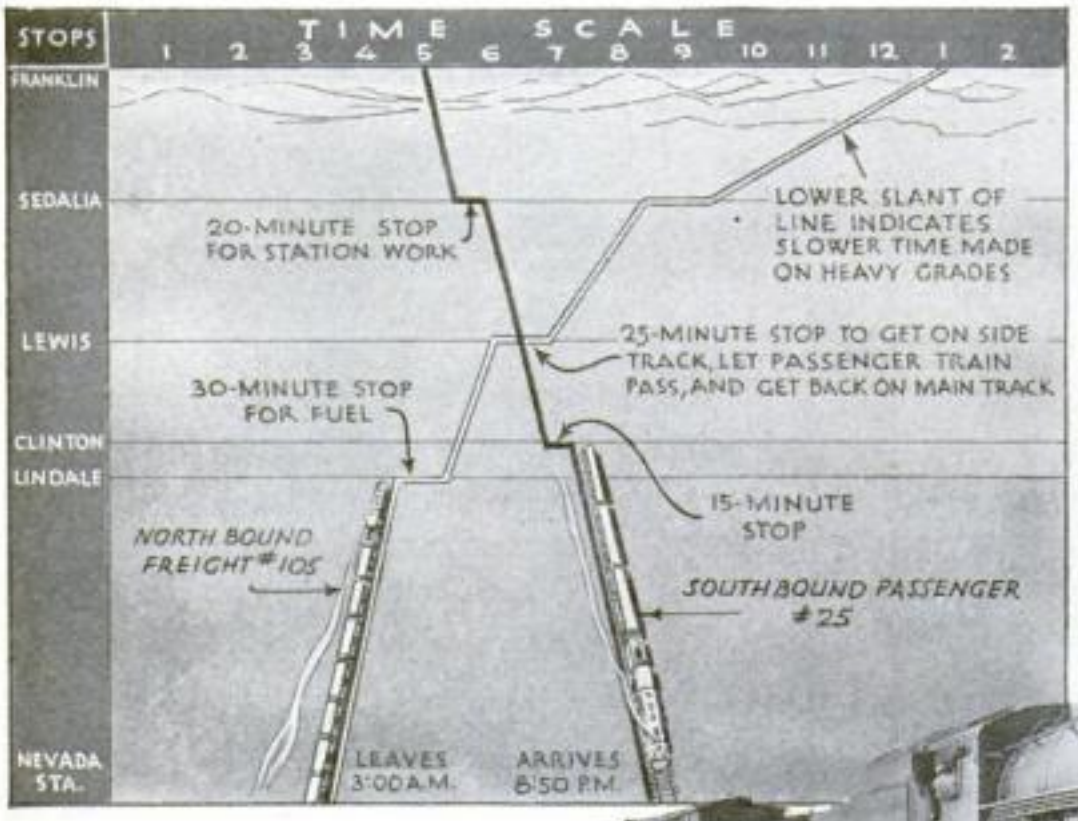
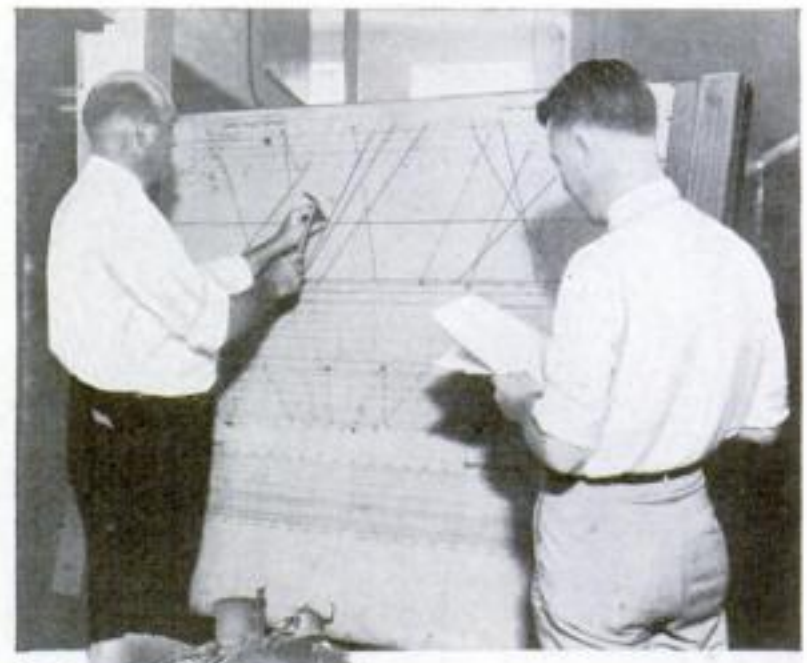


Diagram illustrates the method of "stringing" trains and shows some of the many factors to be taken into account



A railroad superintendent and a trainmaster are shown at work "stringing" a time-table. Each of the strings represents a train. Long freights, like the one at the left, are special problems in allowing for "meets"

CAN you read a railroad time-table? Interesting little stories of railroading, hidden behind the rows and columns of figures, become apparent to one who knows the way in which a time-table is prepared. The method sanctioned by the American Railway Association eliminates guesswork and chance of error. Model-railway fans may enjoy using it to work out schedules of their own.

When a new time-table is to be adopted, the ranking operating official of the railroad submits a tentative schedule to all the superintendents of the line. This is a skeleton affair showing the times of arrival and departure of trains at important terminals only, leaving intermediate points to be filled in.

Each superintendent then calls in his trainmasters and chief dispatchers for the task of "stringing" the trains. This curious operation consists of arranging colored strings, each one representing a particular train and tagged with its number, upon a board reserved for the purpose. Red strings indicate passenger trains, and black strings freights.

Names of the stations on the line, spaced according to mileage, appear in vertical columns at the side margins of the board. Time intervals are marked to scale across the board. One end of the string representing each train is pinned to the point of departure, and the other to the destination, at the points on the time scale called for by the skeleton schedule. Thus each string slants toward the right, its diagonal shift indicating the passage of time en route.

Pins now are placed at intermediate points along the red string of each passenger train, adjusting its course. Where the train must stop for passengers, mail, baggage, or switching, the diagonal progress of the string is interrupted and it is shifted a space or two to the right, designating a carefully calculated time lapse.

Next, the freight trains are similarly adjusted. Here the things that must be taken into account include the weight of the load, the speed called for, the grades encountered, and the location of fueling, watering, and switching points.

Where a black string crosses a red string, a glance at the side margins of the board shows where the freight and passenger trains will meet, if the tentative schedule is adhered to. Dispatcher and trainmaster must know whether there is a suitable siding there. At the selected meeting point, the black string is detoured several spaces to the right, showing time consumed in "making the meet."

When all the strings have been properly placed, the board presents a crisscross pattern of red and black lines showing at a glance the complete story of the operation of every train on the line. The rest is simply a matter of copying the times shown on the board, and arranging the data in conventional time-table form.

SAFE EXPLOSIVE STANDS ROUGH USAGE

MORE powerful than TNT, yet as harmless to handle as putty, is a new "foolproof" explosive developed by chemists at Wilmington, Del. According to its makers, the new product represents a remarkable, and long-sought, advance in safety. In spectacular tests, the new explosive has been beaten with sledge hammers, subjected to the hissing flame of a blowtorch, and shot at with rifle bullets, without being set off. The only thing that will explode it is a full-sized cartridge of dynamite. Made of a secret combination of chemicals, including ammonium nitrate, the yellowish-white substance is described as an explosive for use in times of peace only. Its terrific power will be applied in quarrying and in large-scale "stripping" to break up rocks and coal veins, where its remarkable safety features will greatly reduce the dangers of using an explosive.

Above, the flame of a blowtorch melts a hole in the metal container in which the new explosive is supplied, without detonating it. Left, it is pounded with a sledge hammer safely

TINY BOOK SHOWS LIFE PROCESSES BY "MOVIES"

"Movies" of life processes, prepared in the form of tiny pocket booklets, have just been introduced by the American Genetic Association, Washington, D. C. Adapting a familiar principle for educational purposes, the booklets are examined by flicking over the pages rapidly, causing the black-and-white drawings to become animated. Thus the student obtains a vivid impression of biological phenomena.

This tiny booklet of biological pictures is made into a movie by a flick of the fingers

STREAMLINED SKIERS ATTAIN NEW SPEED

By fitting streamlined fairing to their costumes, skiers at St. Moritz, Switzerland, recently set new world's speed records. Whizzing down the mountainsides, they are reported to have attained velocities ranging up to the rate of eighty-four miles an hour. This is believed to be the highest speed ever reached by a human being without the aid of mechanical propulsion. The photograph shows one of the skiers.

STEEL CAR PROTECTS TUNNEL WORKERS

Workers in western tunnels extending far into mountains now may ride to work without fear of injury from falling rocks, for they have been provided with enclosed steel cars. Hauled by electric engines and equipped with air vents in front and rear, the new cars carry the men in comfort and safety. The picture at the left shows workmen about to board the new vehicle for a trip into a railroad tunnel. Despite the absence of caterpillar treads and other appurtenances, the car strongly suggests a military tank.

MECHANICAL REFEREE TIMES BOXING BOUTS

No longer will the timing of the count depend upon a human's judgment, when a potential knockout occurs during a boxing match, if a timing device illustrated at the right comes into general use. Operated by electricity, the mechanical timer tolls off the seconds after a knockdown in illuminated numerals, so that the critical count of "ten" at which a knockout is declared can be announced impartially and without human error. The device also serves for timing the rounds and the periods of rest for the boxers, between each two rounds, clanging an automatic gong on the second, when round or rest period has elapsed.

Above, the King Tut image as it arrived from Egypt; right, as it now appears, in contrast with man

HUGE EGYPTIAN STATUE REPAIRED IN CHICAGO

A colossal statue of famed King Tut-ankh-Amen of Egypt, standing seventeen feet high and weighing more than seven tons, has just been restored and placed on exhibition by the Oriental Institute, at Chicago. The mutilated relic was discovered by an Institute expedition near Luxor, Egypt, and brought to this country for repair. It dates from hundreds of years before the birth of Christ.

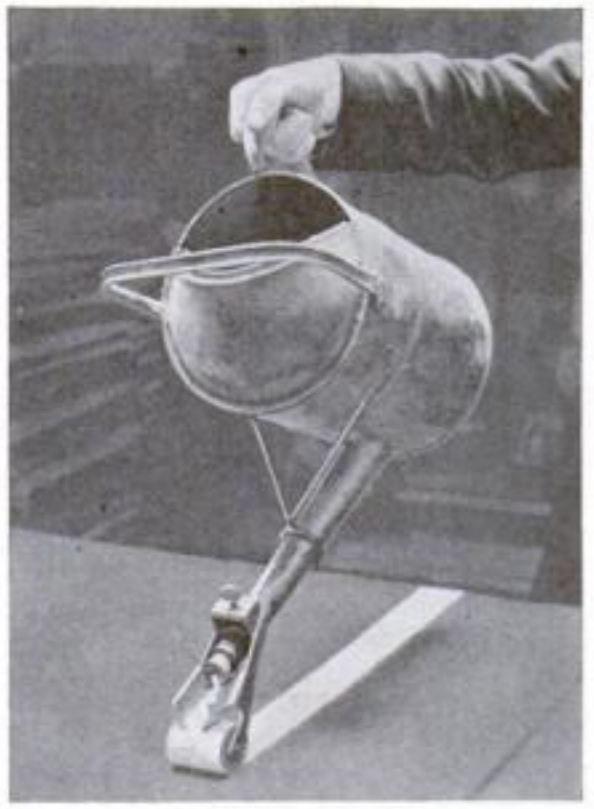
Pumps, operated by the windmills, supply compressed air to drive this novel craft's motor

WINDMILLS GIVE BOAT ITS POWER

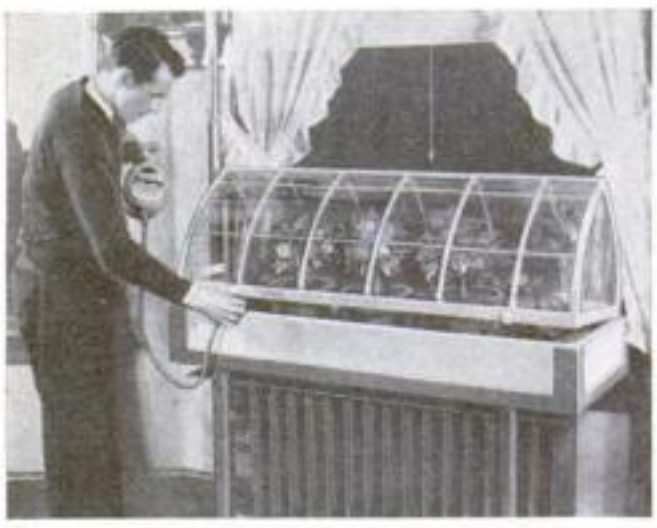
WINDMILLS, mounted near bow and stern, propel a strange pleasure boat that recently made its appearance off Miami, Fla. When a lively breeze sets the vanes whirling, the windmills operate pumps that compress air and force it into large storage tanks. The compressed air thus stored up provides the motive power for a propeller of standard design. By operating an air valve, which releases or shuts off the power supply to the propeller, the pilot can control the speed of the craft at will, and the tanks have sufficient capacity to run the boat for a considerable time.

ONE HAND OPERATES NEW TENNIS-COURT MARKER

A COMPACT and inexpensive device for marking the lines of a home tennis court, recently introduced in England, replaces more cumbersome devices hitherto used for the purpose. The new appliance resembles a watering pot, and is provided with a special spout and spreader for applying the white marking compound. Because it can be handled so easily, it is also useful in touching up worn spots when the entire court does not need re-marking.



Simple device rules lines for home tennis courts



BUILDS WINDOW GREENHOUSE

TO BRING his prized specimens through the winter and early spring, an amateur gardener has built and installed the unusual model greenhouse, shown above, in a bay window over a hot-water radiator. Sheet celluloid covers the exterior of the four-foot house, and a hinged roof provides ventilation. Large plants grow in individual pots; cuttings are sprouted in a one-inch layer of fresh-water sand covering the asbestos floor.

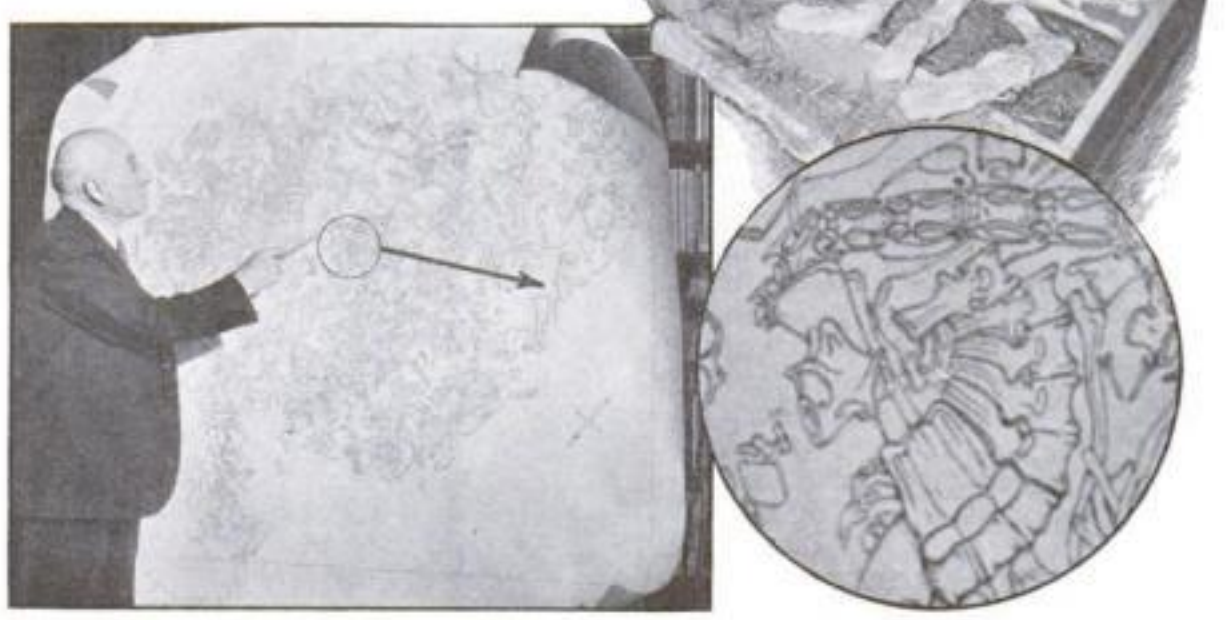
ODORLESS CABBAGE GROWN

A CABBAGE without a smell is the reported creation of Prof. C. H. Myers, Cornell University plant breeding expert. Though it banishes kitchen odors, its flavor is said to compare with the best of standard varieties. From 10,000 seeds now available, commercial growers are to be asked to coöperate in producing additional seeds of the new strain.

DINOSAUR GRAVEYARD MAPPED

PROBING for fossils in Wyoming, Barnum Brown, American Museum of Natural History expert, recently came upon the tangled and interlocked bones of a whole group of prehistoric animals—a find of unexpected richness. To avoid confusing the priceless relics, Brown and his twelve assistants carefully uncovered the surface of the deposit, and laid off the area, which measured forty-five by sixty-five feet, into numbered three-foot squares. Then they prepared a "dinosaur map" showing the location of every bone with respect to the squares. As the bones were recovered, each one was marked with the number of the corresponding square, and shipped to the museum.

Dinosaur bones marked for shipment to a museum



Barnum Brown, discoverer of the huge cache of the bones of prehistoric animals, points out on the "dinosaur map" a circle marking a cluster of relics, which is shown enlarged at right

The Man with the Net

SWITZERLAND *has the most prolific inventors. In proportion to population, it turns out the most inventions.*

ENVELOPES *with gummed flaps that require no licking have recently appeared in Germany.*

ELEVATORS *in New York City carry 15,000,000 passengers a day and travel 120,000 miles every twenty-four hours.*

YOUNG ROBINS *consume as much as three feet of angleworms in one day.*

SIX BOYS *and three girls in one Massachusetts family were born on holidays. The boys arrived on Christmas, Labor Day, the Fourth of July, April Fool's Day, Hallowe'en and Armistice Day; the girls on Thanksgiving, Columbus Day and Easter Sunday.*

SIX AUK EGGS *were sold at a recent auction in London, Eng., bringing $6,877. One of the eggs of the extinct bird sold for $1,500.*

COCKROACHES *can remember a path to food for only about twenty minutes.*

TWELVE-HOUR TRIPS *by balloon from England to Australia were once proposed by a British inventor. His plan was to ascend in a balloon, wait twelve hours, and come down. During that time, he said, the earth would have made half of a rotation, and he would land on the other side of the globe.*

OPOSSUMS, *when born, are so small that a common teaspoon would hold about fifteen.*

EARTHWORMS *are canned and eaten in China.*

THERE ARE *494 blacksmith shops still operating in New York City. Last year, they did a business of $794,000.*

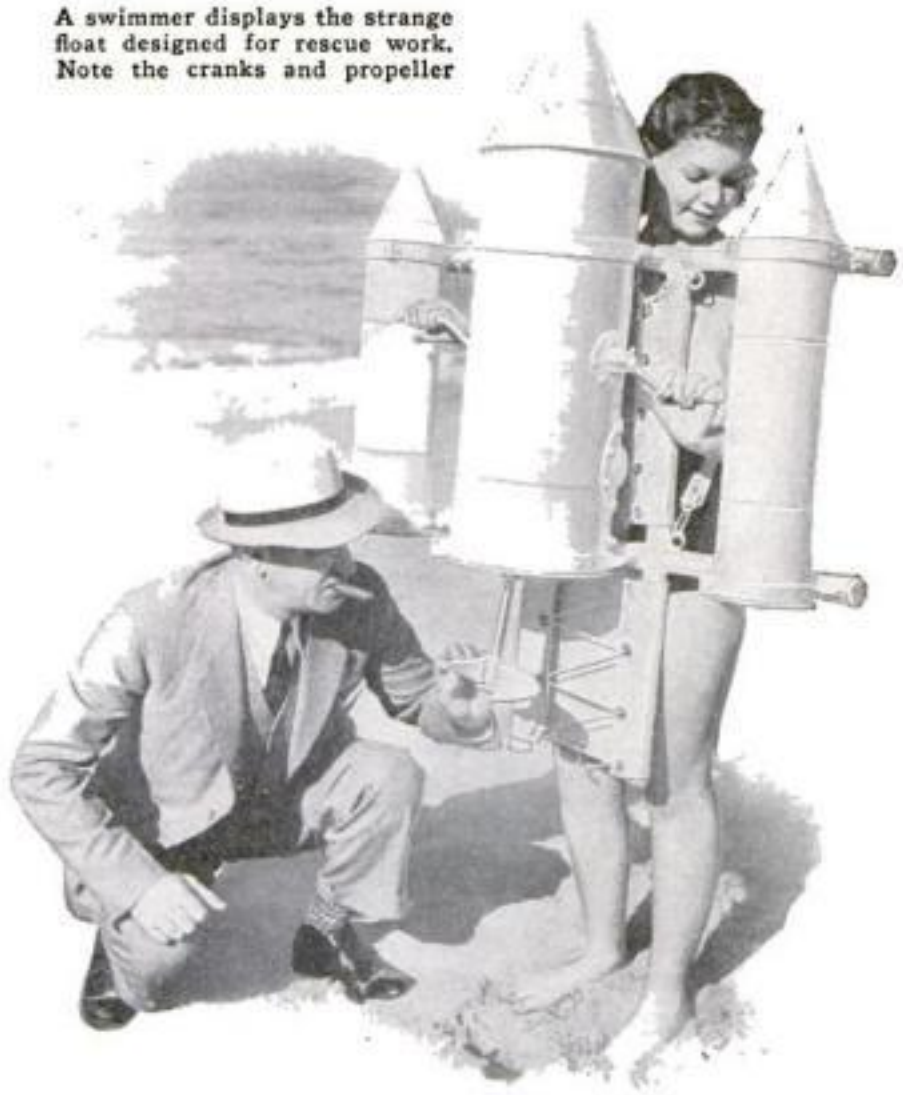
BIRDS *living on insects usually migrate farther south than those living on seeds.*

BULLFROGS *are protected by law in Arizona. In 1933, the legislature established a permanent closed season on the frogs.*

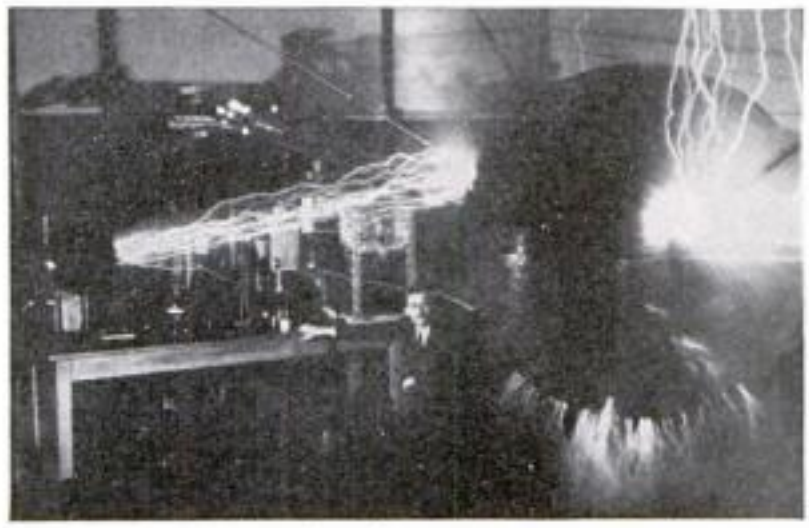
CRANKS PROPEL ODD RESCUE FLOAT

THOUGH its design suggests some rocket-propelled craft of the future, a curious floating device designed by a Santa Monica, Calif., inventor is intended to serve the eminently practical purpose of rescuing swimmers in distress. Its three rocketlike cylinders are actually buoyancy tanks of bronze, and are capable of supporting a weight of 180 pounds. By operating hand cranks, a life guard can spin the small propeller at the stern and propel himself at a lively pace to the aid of a bather, who can then be helped ashore without danger to rescuer or rescued. The user reclines on a small platform of canvas above the large central float and turns the cranks with an easy, natural movement.

A swimmer displays the strange float designed for rescue work. Note the cranks and propeller

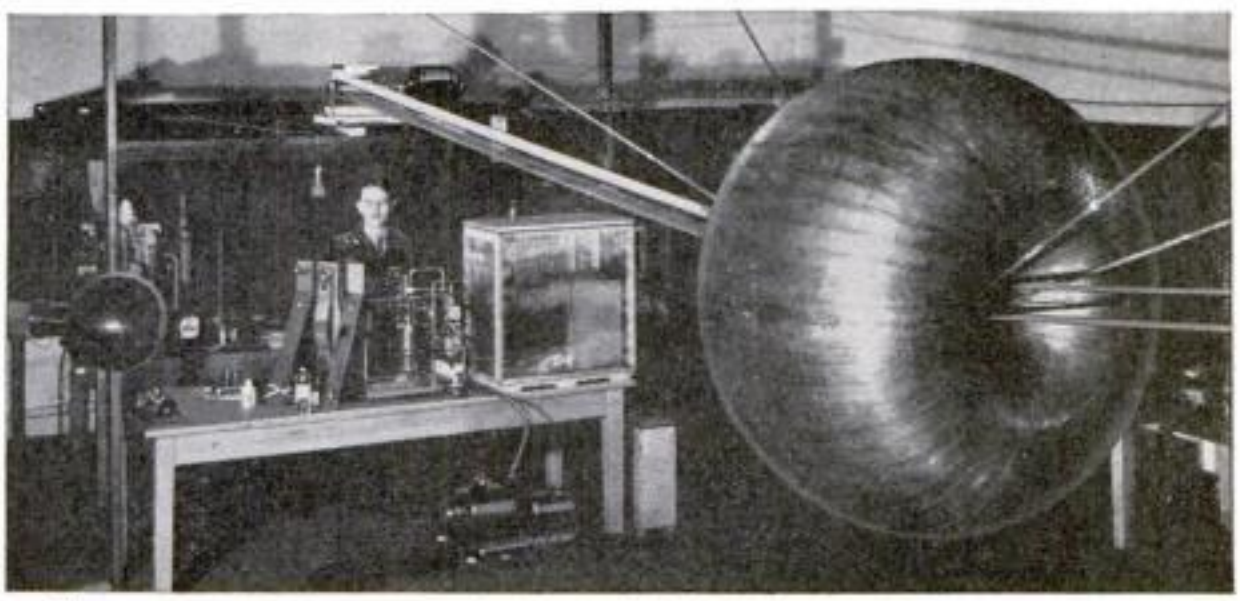


METAL DOUGHNUT MAKES ELECTRICITY



A spectacular display of artificial lightning produced by a huge new laboratory generator

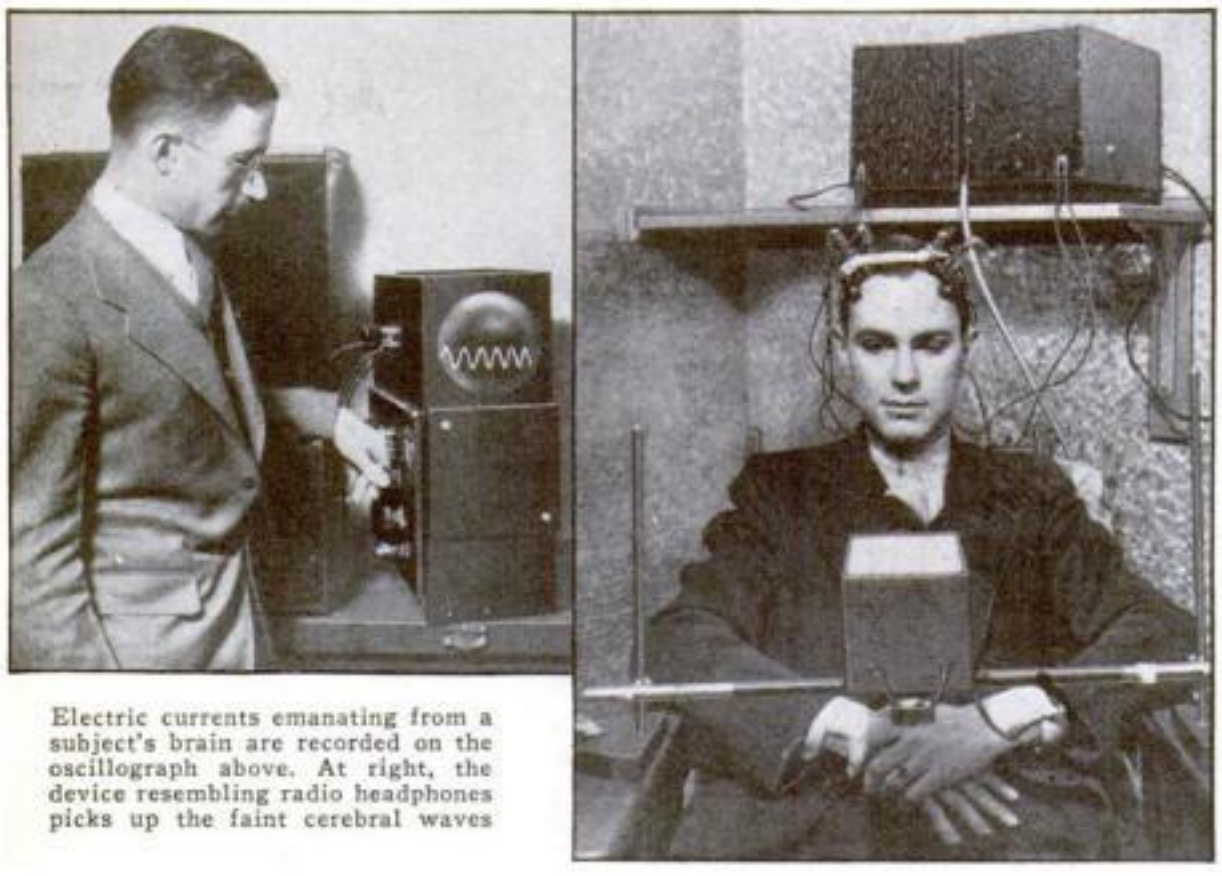
A GIANT, hollow doughnut of copper serves as the business end of a 1,000,000-volt electric generator completed at Ohio State University. When a whirling, endless silk belt piles up a sufficient charge upon the metal surface, sparks leap from the doughnut in a fantastic pattern of zigzag lightning. A larger machine of similar principle, built at the Massachusetts Institute of Technology, requires an airship hanger to house it, but the latest model is compact enough to fit inside a science laboratory of ordinary size. It also is declared to be a far more economical type to construct. Electrified particles, produced by the new generator when it is coupled to a high-voltage vacuum tube, will be hurled against atoms in attempts to break them up and reveal their structure.



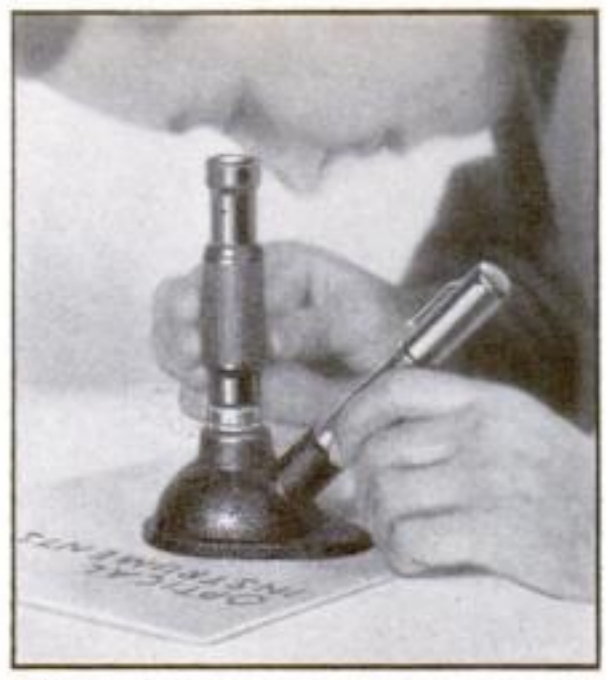
The new 1,000,000-volt generator, showing the silk belt that produces high voltages by friction

NOW YOU CAN SEE YOURSELF THINK

WATCHING yourself think is now a scientific possibility, according to two Brown University psychologists who report that they have detected electric currents emanating from the brain. The electric waves, they find, vary with the subject's health and also with his concentration on a mental problem. Electrodes attached to the subject's head pick up the waves, which are amplified and made visible as wavy lines in a standard laboratory device known as an oscillograph. Photographs of these patterns, named "electroencephalograms," may be important in medical diagnosis.



Electric currents emanating from a subject's brain are recorded on the oscillograph above. At right, the device resembling radio headphones picks up the faint cerebral waves



FLASH LIGHT USED WITH NEW POCKET MICROSCOPE

AN ORDINARY fountain-pen flash light provides illumination for a small microscope of new design, that may be carried in the pocket. The flash light is inserted in a socket at the base of the instrument and throws its beam at an angle, aiding in the examination of such objects as documents, textile materials, and metal surfaces. Interchangeable eyepieces on the microscope provide a variety of magnifications ranging from thirty-five to 105 diameters.

Above, the novel brain tester in use. At left, the internal mechanism that separates correct and incorrect answers

ROBOT CHECKS ANSWERS IN INTELLIGENCE TEST

A NOVEL "brain tester" for parlor or schoolroom confronts the subject with tokens bearing printed questions. His task is to drop them into receptacles bearing the correct answer, "yes" or "no." Hidden magnets, acting in conjunction with iron or brass strips within the tokens, sort the responses. Correct ones are all found in one compartment, and wrong ones in another. The questions may be suited to children or adults.

STICKERS IN NEAT PACK

STICKERS gummed on both sides have recently been introduced, providing a handy way of mounting photographs, sticking clippings in scrap books, and attaching window signs. A convenient swivel method of binding facilitates detaching a single sticker, as shown at right.

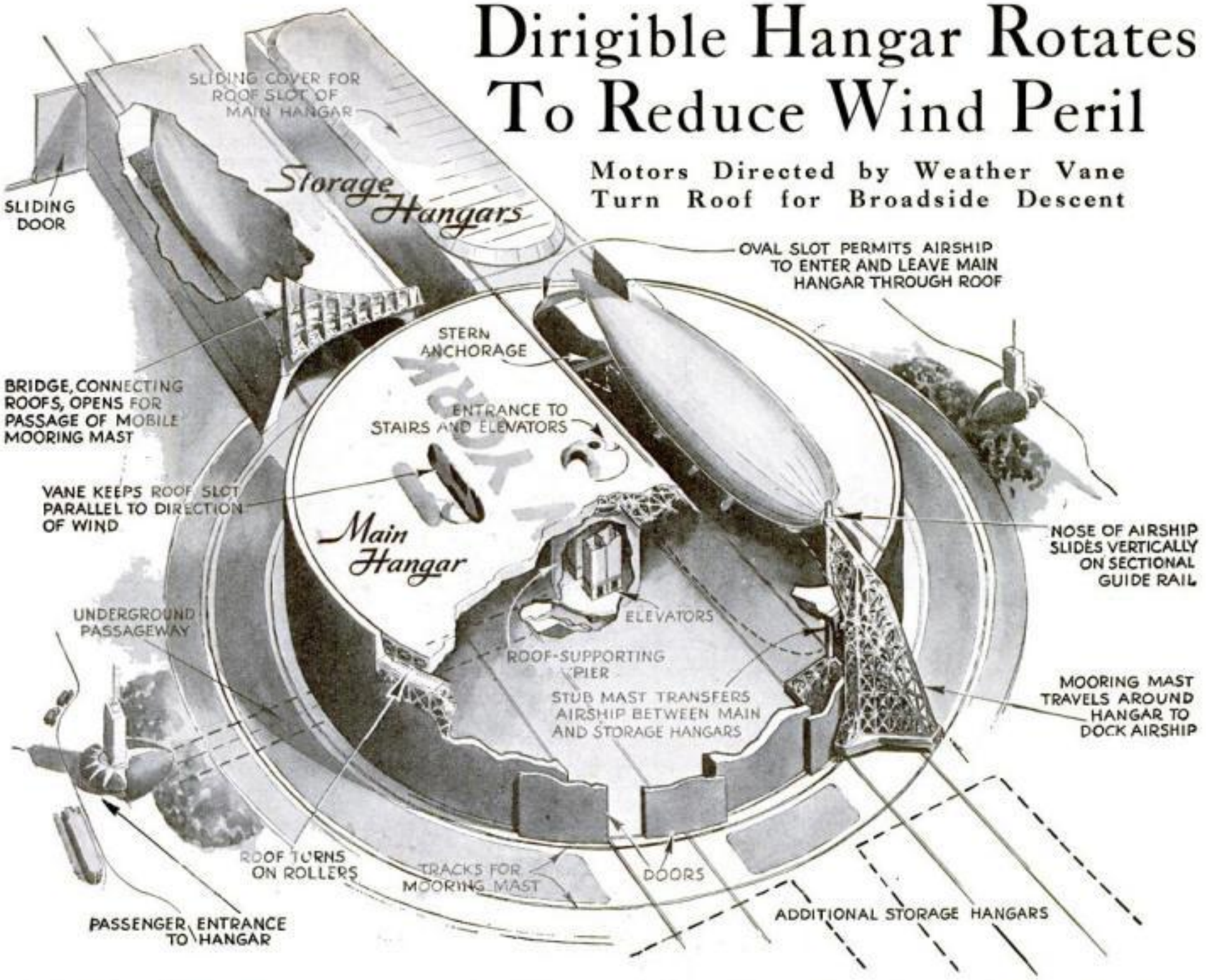
PIANO FOR INVALID PLAYED FROM BED

A PIANO devised by a British inventor can be played by an invalid who is lying in bed. When the front of the instrument is unfolded, the keyboard is brought within easy reach of the reclining performer. Levers and wires connecting keys and action operate so smoothly that the piano is said to have the standard two-ounce touch. "Pedals" are operated by pressure of the knees of the player.

Picture shows how reclining invalid can play upon tilted keyboard of piano that fits over her bed

Dirigible Hangar Rotates To Reduce Wind Peril

Motors Directed by Weather Vane Turn Roof for Broadside Descent



A NEW way of docking dirigibles, proposed by a New York inventor, would avoid exposing them to the peril of a sudden sideward gust of wind while being walked in or out of a hangar door. A "hatbox hangar," permits the craft to be lowered or raised broadside through an oval aperture in the hangar roof. This slot is automatically kept aligned with the direction of the wind by electric motors, operated by a wind vane, which rotate the entire hangar roof on rollers. An incoming airship is taken in tow by a mobile mooring mast and brought into position for passengers to use the roof as a landing platform. The ship is then maneuvered over the entrance slot, where it is made fast to guide rails and lowered into the hangar. Elevators convey passengers between the roof and the ground level, where an underground passage offers access to the exterior. Additional equipment of the "hatbox hangar" may include power cars or "electric mules" to aid in handling the mooring lines, and mobile stub masts for moving airships about within the hangar.

CYCLE RIDES SNOWDRIFTS

Snow cycle in use, showing how skis at side keep the novel machine in balance

FOR TRAVELING at high speed across snow-covered country, an inventor of Munich, Germany, has introduced a motor cycle with an endless tread. A flexible belt, passing around front and rear wheels and supported midway by auxiliary rollers, propels the machine and keeps it from sinking into drifts. Seated astride this odd vehicle, the rider balances himself by means of skis. A fast ride over hard-packed accumulations of snow offers exhilarating sport.

DESK TOOL SEALS MAIL IN TWO RAPID MOTIONS

WITH THE aid of a handy new desk accessory, envelopes are quickly and neatly sealed. When the appliance is drawn along the flap of the envelope as shown in the photo, water from a felt pad moistens the gum. The sealer is then passed over the flap again, this time on the outside, closing the envelope.

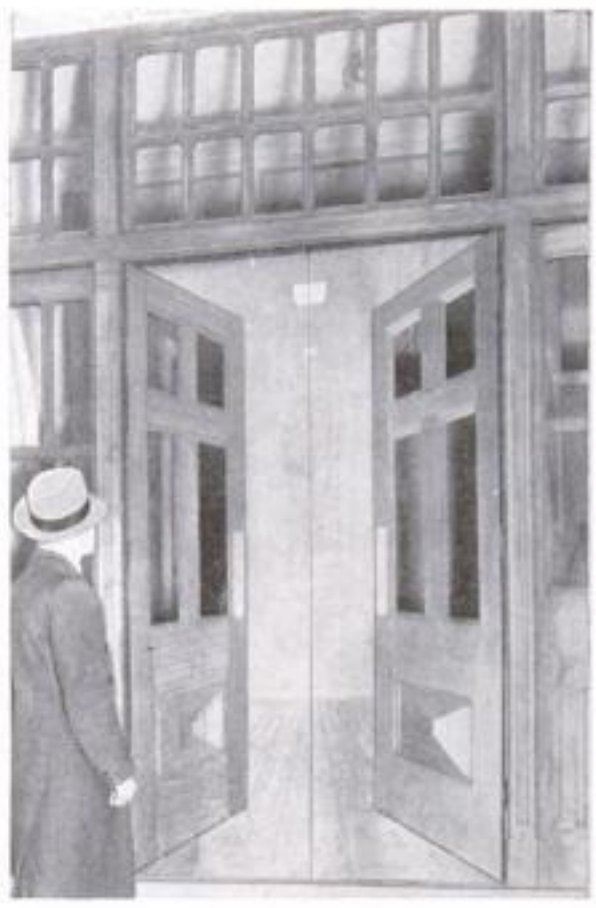
Fast new automatic photograph machine in use. Above, a framed picture made by it

SLOT MACHINE MAKES FRAMED PHOTOS

A COIN-IN-THE-SLOT machine that not only takes your picture, but frames it as well, has just been introduced for use in stores and amusement resorts. The entire operation requires only twenty-five seconds. After entering the booth and inserting a coin, the sitter turns a handle that sets the apparatus in action. A whirring sound is heard as a camera snaps the picture, the negative is transferred to a high-speed developing bath, and a finished photograph in a round metal frame rolls out of the machine. The operation of the machine is completely automatic, and does not require the presence of an attendant.

DOOR PAINTED TO SEEM OPEN WHEN IT IS SHUT

BUMPING into a door would be an understandable mishap at the centuries-old residence of one British doctor—for among its curios is a doorway painted in such a way as to appear open, when it actually is closed. The striking optical illusion, shown in the accompanying photograph, was created by a whimsical architect of 200 years ago. The original doors have just been replaced by copies.



FINGERS ARE TYPE BARS ON ODD WRITING DEVICE

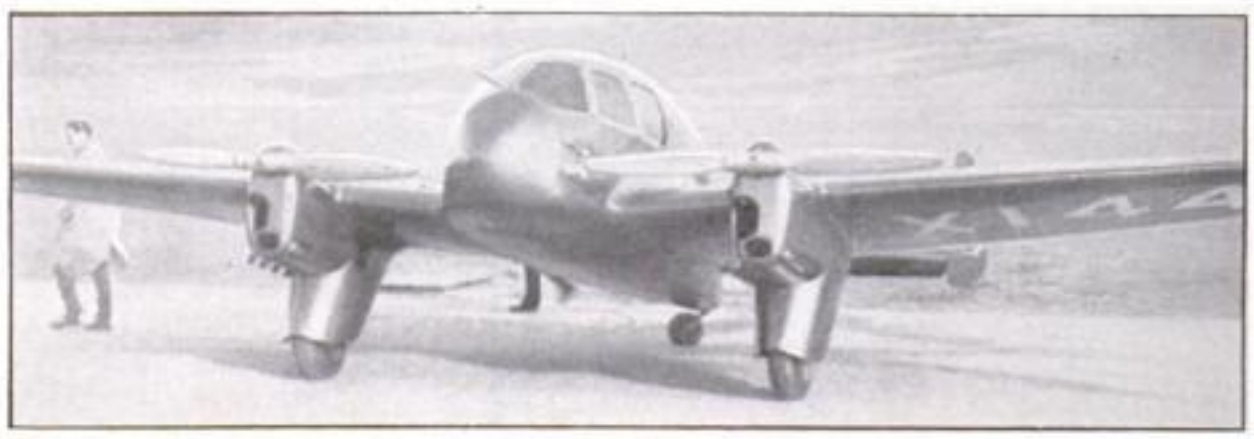
A "TYPEWRITER" that uses human fingers for type bars is the invention of an Austrian merchant. The typist dons a pair of gloves bearing several type characters, and by nimble manipulation of the fingers the desired characters are impressed on the sheet. Two parallel guide rails, a small carriage bearing the typewriter ribbon, and a mechanism for automatic spacing, complete the outfit. According to the inventor, his device should be especially useful for making typed entries in books and on sheets of such a size or shape that they cannot be inserted in a standard typewriter. The photograph shows it in use.

PROSPERITY SEEN IN LOW BIRTH RATE

POPULATION statistics support a prediction of prosperity for the country during the coming quarter century, according to Dr. O. E. Baker, U. S. Department of Agriculture economist. A declining birth rate will have left fewer children to support. Meanwhile the proportion of population in the "productive" ages from twenty to sixty years will be higher than it ever has been before.

TEARDROP PLANE ATTAINS HIGH SPEED

SAID to be capable of a speed of 250 miles an hour, a four-place, teardrop monoplane of radical design has just been completed in a Denver, Colo., shop. Its originator, a young aeronautical engineer, maintains the craft to be 100 miles an hour faster in the air than a standard plane of similar passenger-carrying capacity, although it takes off and lands at no higher speed. The shape of the cabin is said to make it act as a wing and become self-supporting in full flight. Rudders are built into the twin tails, while the elevator is mounted between them. Two motors of 125 horsepower each drive the strange machine.



Two views of new teardrop plane, showing unusual design of cabin which adds to the craft's speed

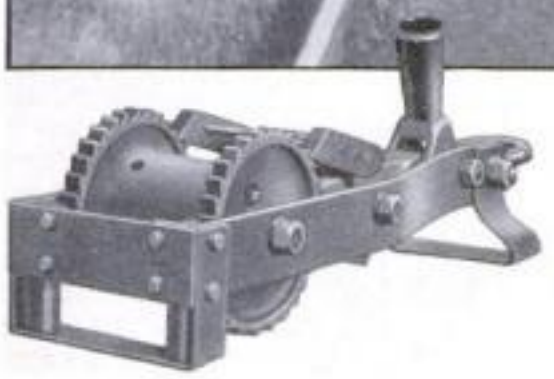
FISHERMEN USE SHOVELS IN DRY LAKE

A MYSTERIOUS vanishing lake has Florida's state fish and game department puzzled. Normally this body of water, known as Lake Iamonia and situated near the Georgia line, covers an area of twenty square miles to a depth of from thirty to forty feet. Not long ago, however, its shore lines began receding. Within a few weeks virtually all of the water had disappeared through a hole in the bottom, about two hundred feet square. Millions of fish, with which the lake abounds, were left floundering in the mud, and their bodies clogged the tiny pool that remained in the hole. Game laws were suspended. Fishermen used shovels and baskets.

Fishermen reaping an unexpected harvest from the bottom of a Florida lake as water disappears

SIRENS GUIDE SHIPS FROM LONGEST BRIDGE

HUGE electric sirens have been installed on six of the main piers of the new San Francisco—Oakland Bay Bridge to sound warnings to direct vessels entering or leaving the harbor during fogs. Each siren, by means of a small coding device, sends distinct signals, heard ten miles away.

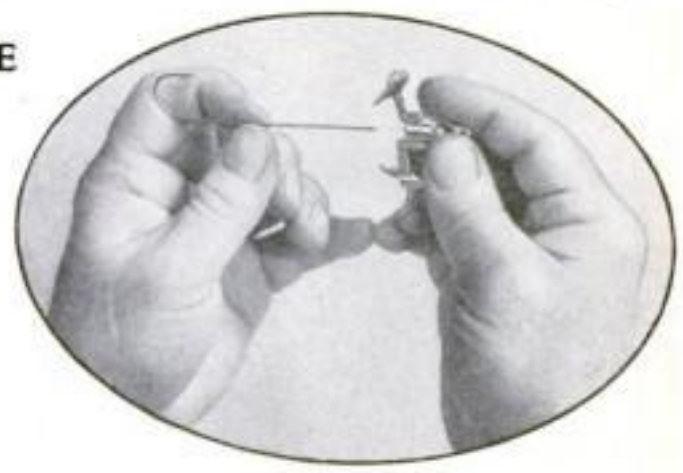


NEW JACK ENABLES ONE MAN TO PULL BIG LOAD

ONE MAN can easily move a freight car, pull a stump, or haul an automobile out of a ditch with the aid of a new jack designed for heavy-duty pulling jobs. The jack is simply anchored to the nearest immovable object and a wire cable attached to the thing to be moved. Working the handle winds up the cable on a drum, exerting a tension of more than ten tons if necessary. The pictures above show the jack and a demonstration of its use for moving a loaded railroad car.

HOOK COMES OFF LURE

AN INGENIOUS new lure for game fish provides a pair of vanelike jaws that secure the bait, and an automatic clutch that grasps the hook. When a catch has been made, fish and hook can be detached instantly by pulling a trigger. By substituting a new hook, a sportsman can have his line in the water again in fifteen seconds, when fish are rising.



DRILL SINKS MINE SHAFTS IN ROCK

JUST as a carpenter's auger drills a hole through a plank, so a huge machine perfected by a Grass Valley, Calif., inventor, sinks a mine shaft of eight-foot diameter through solid rock. A revolving cutter is turned through reduction gears, by a forty-horsepower electric motor, at a rate of about twenty revolutions a minute. Its business end consists of a circular frame bearing a row of hardened teeth, beneath which hardened shot are poured to serve as the abrasive while the device is in operation. The operator has a seat above the motor, and is lowered with the drill.

Giant drill in use, boring a mine shaft into solid rock. Note teeth at bottom of cylinder. Right, a typical section of the rock core cut out by the drill and removed from the shaft

Odd Mental Kinks

PRODUCE STRANGEST CLASS OF

Criminals

By
ARTHUR GRAHAME

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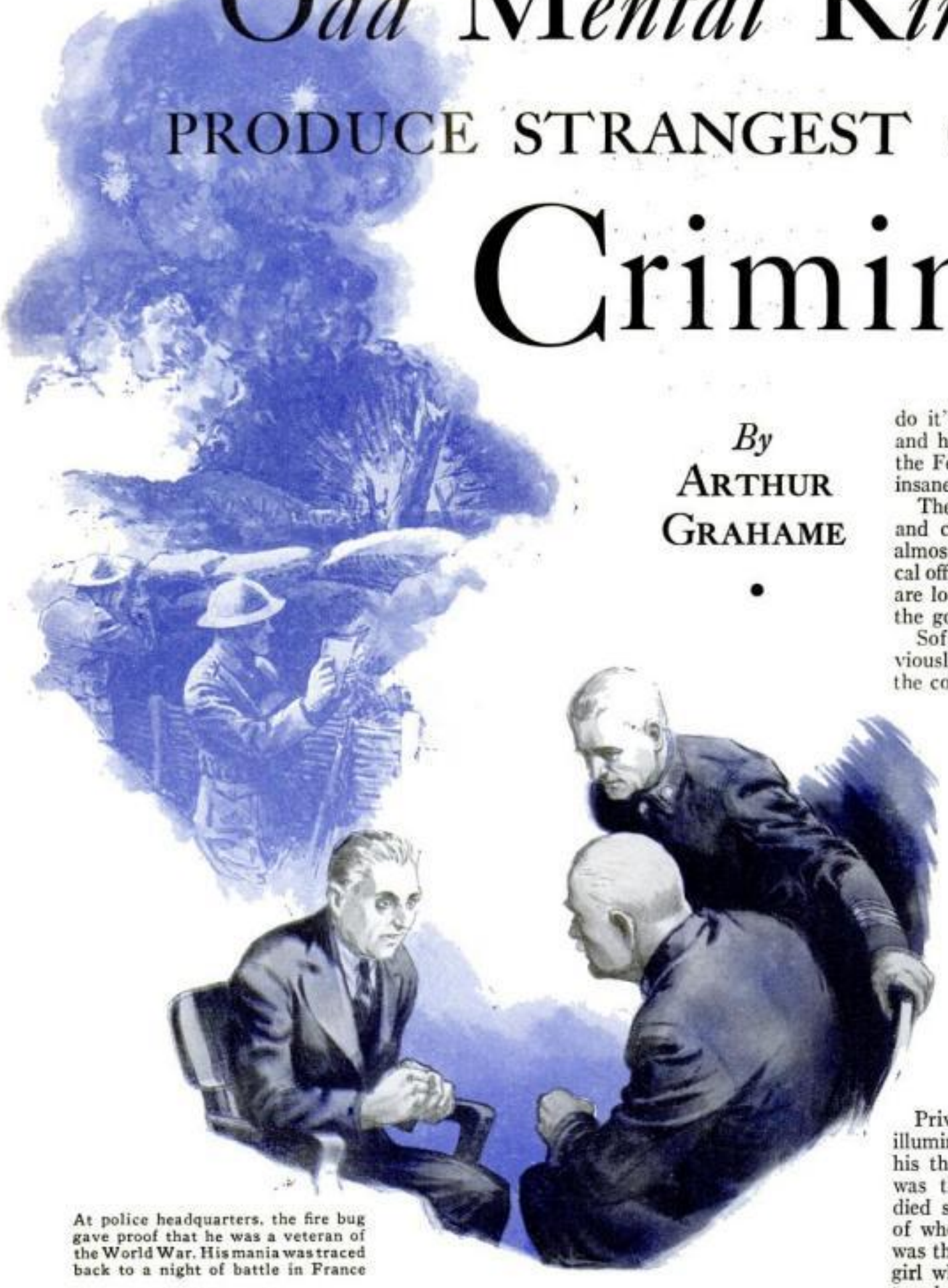


At police headquarters, the fire bug gave proof that he was a veteran of the World War. His mania was traced back to a night of battle in France

ON A windy night a number of years ago, residents of the National Capital were startled by the breaking out, almost simultaneously, of several dangerous fires in the downtown business district. Gongs clanged. Sirens shrieked. The white dome of the Capitol reflected the ruddy glare. Every piece of apparatus and every man of the city's fire department was hurried into action, but, in spite of the firemen's efforts, the flames spread. Hundreds of thousands of dollars worth of property was destroyed, and many lives were endangered.

In the large crowds that gathered, there were, of course, many people who were highly excited. But the strange, half-repressed emotion of one man in particular aroused the suspicion of a sharp-witted policeman. After watching this man for several minutes, the policeman walked toward him. The man saw him coming, leaped into a car parked at the curb, and started to drive away. The policeman blew his whistle. The man stepped on the gas, bumped recklessly over several lines of fire hose, and speeded down the street until his way was blocked by another car, and he was arrested by a motorcycle policeman.

At police headquarters, he gave proof that he had a good job as a painter, and that he was a veteran of the World War who had served creditably in France. He had no criminal record. But his manner was so strange that the police continued their questioning, and before long he confessed that he had started all that night's fires, in addition to several minor blazes of the recent past. The only explanation that he would give was that he "had to do it". Alienists pronounced him insane, and he was committed to St. Elizabeth's, the Federal Government's hospital for the insane near Washington.

There he came under the observation and care of Dr. John E. Lind, who for almost twenty years has been senior medical officer in charge of Howard Hall, where are lodged the criminal insane who are in the government's care.

Soft-voiced and kindly, and yet obviously no sentimentalist, Dr. Lind won the confidence of the fire-setter—we'll call him "Jones." And having won his confidence, Dr. Lind soon learned why he had started those fires.

It all went back to a night of battle in France.

Standing in a muddy trench, Private Jones stared over the parapet. A heavy bombardment was shaking the earth, and low-lying clouds sullenly reflected the flash of guns and the glare of bursting shells. Varicolored signal rockets were going up from the German trenches. The merciless white light of star-shells brought out in sharp relief the grim details of No Man's Land. Somewhere behind the enemy lines a burning ammunition dump blazed fiercely.

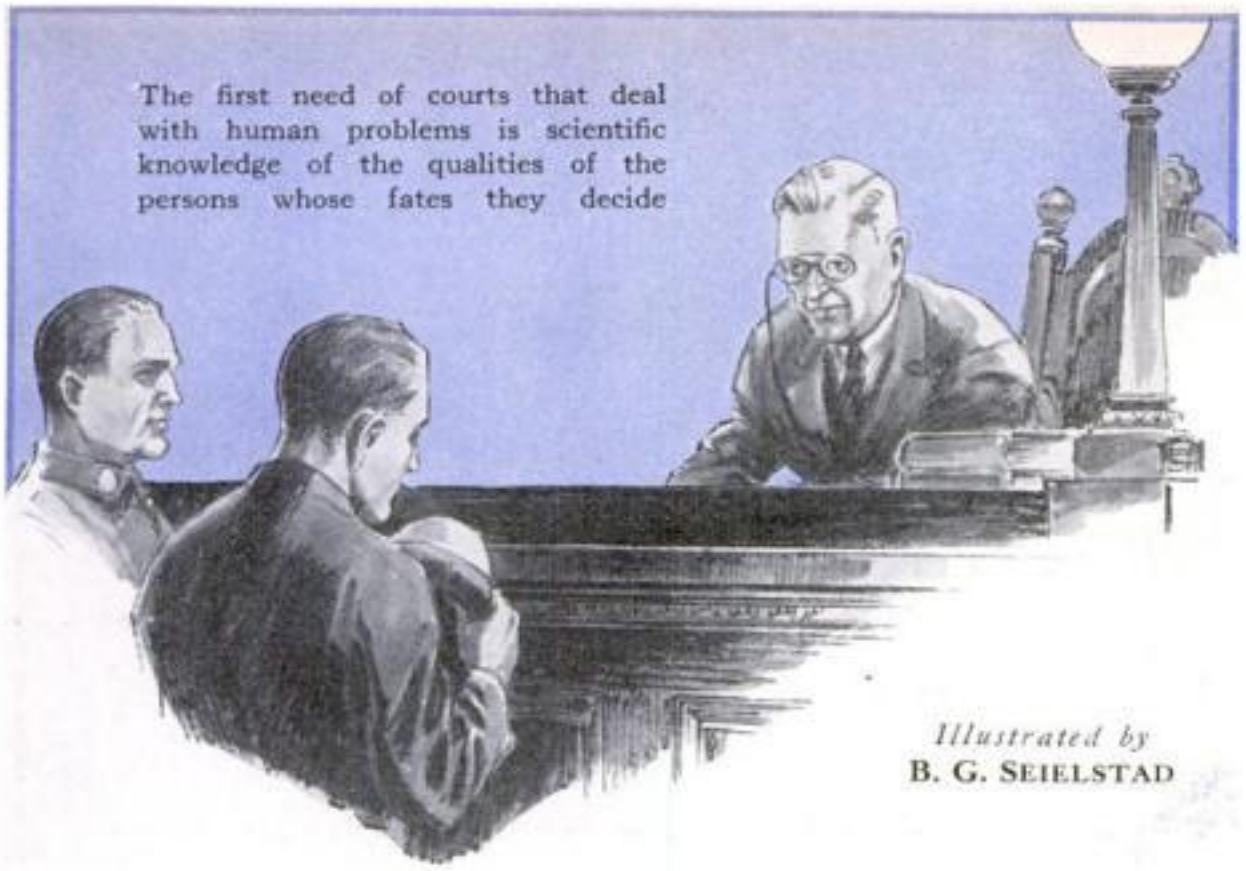
Private Jones' eyes were on this luridly illuminated sector of man-made hell, but his thoughts were far away from it. He was thinking about his sister, who had died since he had landed in France, and of whom he had been very fond. And he was thinking about another girl—a French girl who looked much like his sister, and to whom he had become engaged.

A RUNNER who had been back to battalion headquarters handed him a letter. It was from the French girl. As soon as he could, he went into a dugout where there was a candle burning, and read it.

The French girl was very sorry—but she had decided to marry another man.

Private Jones went back to his trench—back to the night of fire. He went on doing his duty, and he went on thinking about those two girls. At last the war ended, but whenever he thought of the girls he remembered that night of fire when he had received the French girl's letter.

That memory did something to his mind. He began to feel that he must see another night like that. The desire became so strong that one night he started a small fire. He was not suspected. Other small



Illustrated by B. G. SEIELSTAD

fires followed. Then he set fire to an ammunition dump; again he escaped detection. On his return to America he was discharged from the army, and got a job in Washington. But his "compulsion" to start fires persisted, until in the end he set the series of big blazes that was his undoing.

At St. Elizabeth's he has been a model patient. He has shown no signs of being mentally abnormal. A psychologist has treated him, and thinks that he has rooted out his compulsion to start fires. The hospital medical officers also think that he has been cured. Before long a court of law will be asked to decide whether or not it is safe to allow him to return to everyday life. The chances seem to be in favor of his being given a chance to make a fresh start.

"Cases like that of 'Jones'," says Dr. Lind, "confirm me in my belief that no one sent to prison for committing a crime should be sentenced for a term of definite length. I know a man who served fourteen years for second-degree murder when it would have been perfectly safe to release him within a few months; and I know a man who was sent to prison for a short term for a minor theft, who should have been kept under restraint for the rest of his life for the protection of society.

"All criminals are not insane, but many of the people who commit crimes have some sort of mental 'kink' that makes them act criminally. When that kink has been straightened out—and not until it has been straightened out—it is safe to allow them to return to normal life."

Although, apparently, "Jones" has had his fire-setting kink straightened out, when he was sent to St. Elizabeth's he was a psychopath—a man with a sick mind. Many others of Dr. Lind's patients are members of the psychopathic personality group to which a large proportion of habitual criminals belong. These unfortunates are sent to St. Elizabeth's after they have shown pronounced symptoms of mental illness while inmates of one of the Federal prisons.

Fifty years or so ago, Cesare Lombroso, the Italian who was the first scientific criminologist, shocked conservative thinkers by saying that a great many criminals couldn't be blamed for being criminals, because they had been born that way. The brain of the habitual criminal, he declared, was organically different from the brain of a normal man. Even more astonishingly, he said that many criminals could be transformed into honest men by giving them proper medical treatment, and that many potential criminals could be made into useful members of society by giving them early training in work that would allow their peculiar instincts a lawful outlet. He suggested soldiering or surgery or the butcher's trade for youths with proclivities to murder, and the police force or journalism for those with a propensity to swindle people!

Few of Lombroso's beliefs have stood the tests of time and scientific investigation, but one of them has become the keystone of modern scientific criminology —the belief that crime is a disease and the criminal a mentally sick man, and that trying to cure him is much more sensible than punishing him.

But criminologists, like everyone else, have to work with the tools they have while they try to evolve better ones. No one has found a method of curing desperadoes of the John Dillinger and "Machine Gun" Kelly type, so for the good of the law-abiding majority they must be killed or sent to some grim and closely guarded prison such as Alcatraz. Nor does the case of the obviously insane person who has been guilty of a crime constitute much of a puzzle. He must be sent to a hospital for the mentally diseased, and treated for his troubles. If he is cured he is released; if the psychiatrist's science fails to cure him, he must be kept under restraint for the protection of others.

The scientific criminologist's most puzzling problem is what should be done with and for the psychopath—the border-line criminal who is too sane to be kept in an asylum, but not sane enough to be left at large.

IN MURDER and other major-crime trials, insanity is a very common defense. Justice Wilbur, of the Supreme Court of California, has said that most pleas of insanity are made by sane people, who frequently go free, while most insane criminals make no insanity plea, and are duly sent to prison. But in major-crime cases the mental condition of the prisoner is at least examined carefully, while in most courts the mental condition of a man accused of a minor crime seldom is investigated. If convicted, he is sent to prison for a short term, and when he has served it he is released. If he is a psychopath he may commit another similar crime within a short time. Dr. Lind knows one unfortunate man of this type who has spent thirty-one of his forty-five years in serving short terms in various penal institutions!

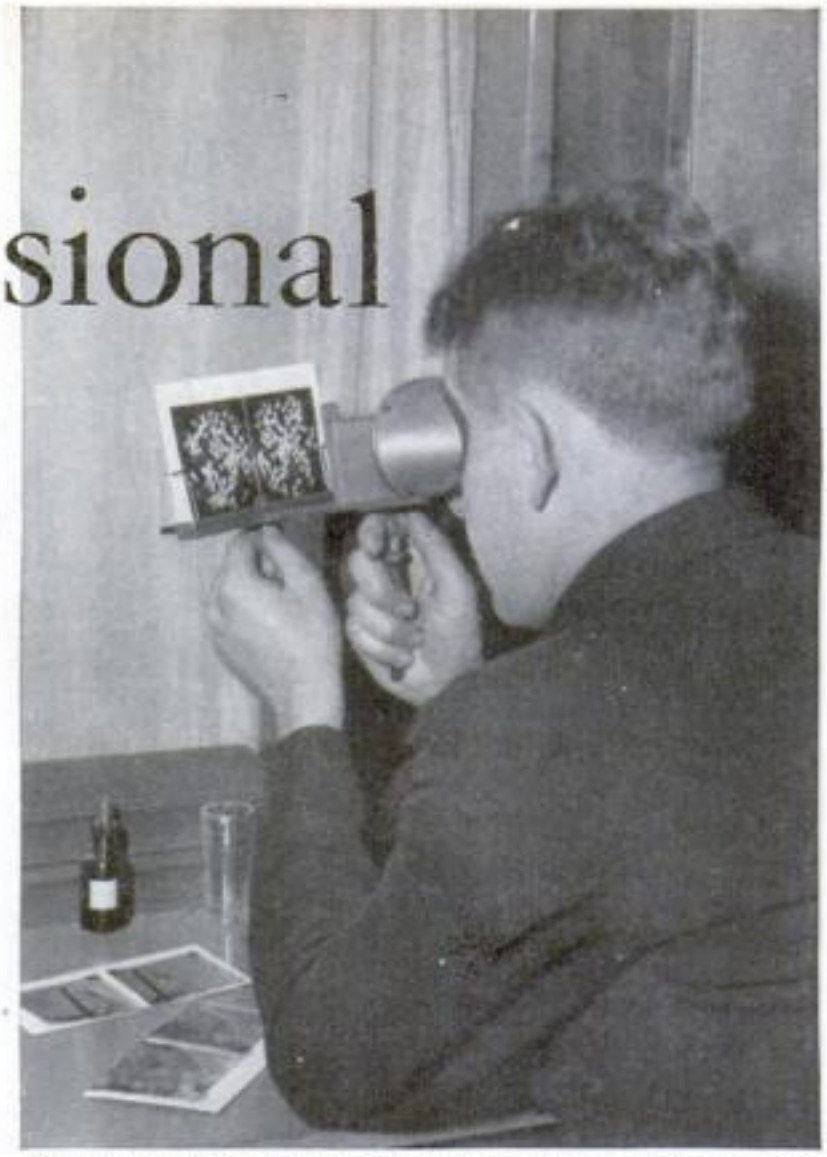
No one knows what makes the psychopath what he is. Some students think that he is a victim of defective metabolism—that there is something wrong with the process by which his body assimilates new materials to repair waste. Others say that he is a sufferer from functional defects of the mind. Dr. Henry Maudsley, a distinguished British alienist, accounts for him by saying that he suffers from a perversion of the mental faculties that usually are called the active and moral powers, and that his incapacity for true moral feeling causes him to yield without a struggle to all his egoistical impulses and desires.

WHATEVER may be the underlying cause of the psychopathic personality, its characteristics are easily recognized. Psychopaths cannot adjust themselves to ordinary life. They are creatures of weak will and without self-restraint, who are incapable of following any plan of action to its end. They never plan for the future. With them, the smallest present gain outweighs any future good.

The largest of all the groups of psychopaths is composed of nomads, men who always escape any responsibility by "moving on". Some of them run up bills in various cities, and then move away to avoid the consequences of not paying them. Others drift away from their family responsibilities. Many professional tramps and hoboes belong to this group. Nomads often enlist in the army and navy and soon desert. *(Continued on page 110)*

Many professional tramps and hoboes are psychopaths. They evade all responsibility

MAKING Three-Dimensional PICTURES *with Your Microscope*



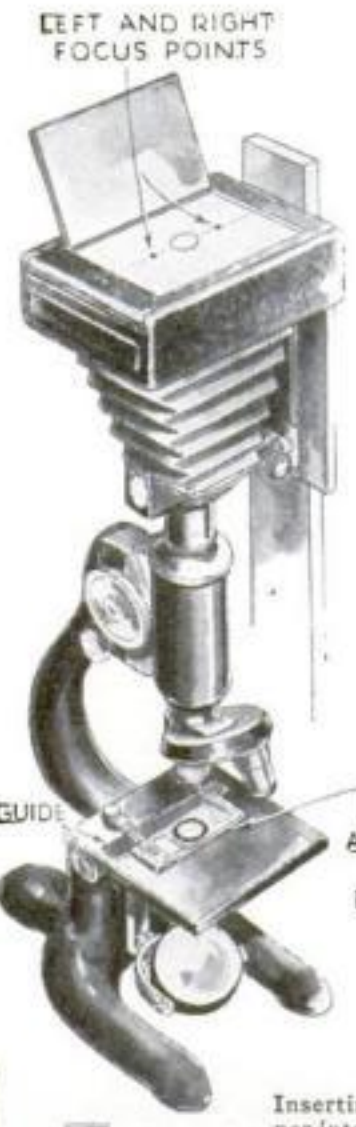
Photographs made in pairs under the low-power microscope take on the illusion of depth when they are examined, as above, in the common stereoscope, an optical device found in many homes

ALMOST every amateur microscopist who has ever hooked a camera to his microscope has become a convert to the fascinating hobby of photomicrography. But unless he has investigated the possibilities of three-dimensional photomicrography, he has missed some of the biggest thrills that the combined sciences of photography and microscopy have to offer.

Inexpensive equipment has placed photomicrography within the reach of every amateur. The owner of a microscope who does not wish to purchase a camera that can be attached to it, can make one out of odds and ends. This involves simply the mounting of an old focusing-type plate camera of four-by-five or five-by-seven-inches so that the microscope is in the position formerly held by the camera lens.

The making of high- or even medium-power stereo-photomicrographs involves difficulties that would tax the abilities of an expert. For one thing, the depth of focus of microscope lenses at magnifications of even 100 or 200 diameters is too small to give satisfactory three-dimensional effect. Also, there would be no advantage in making a stereoscopic picture of extremely thin specimens, such as sections of tissue a few microns thick.

But when you come down to relatively low magnifications of ten to fifty diameters, the situation becomes entirely different. Within these magnifications are thousands of objects which lend themselves to stereoscopic reproduction. The depth of focus of microscope objectives at low powers is sufficient to capture some of the third-dimensional details of suitable specimens. By means of a few tricks, the microscopist can increase the depth of focus of his lenses in many cases.



How the camera is set up above the body tube of the microscope, for making the twin pictures, the centers of which must be just about as far apart as the human eyes

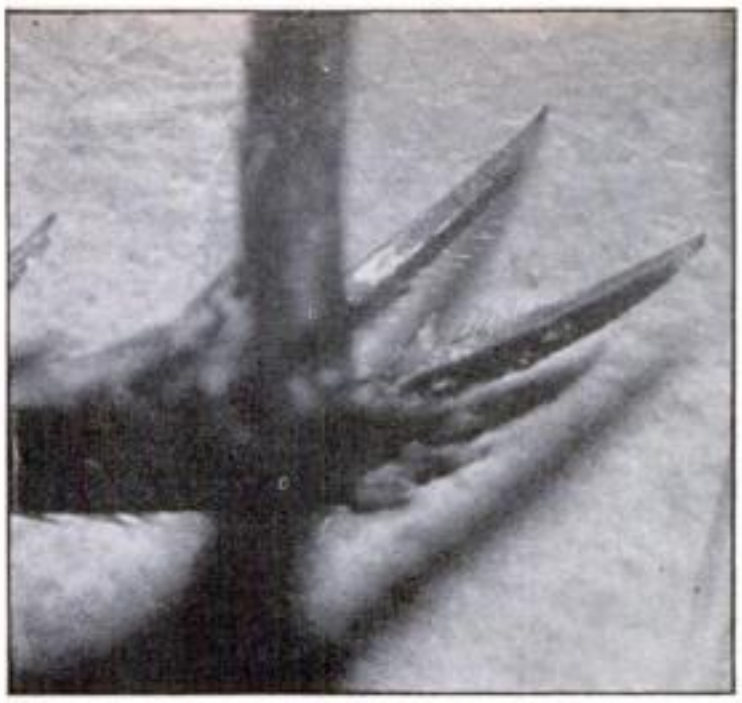
Even without a microscope, there are wonderful possibilities for making unusual stereoscopic pictures of small objects. By means of a short-focus photographic lens placed at a considerable distance from the sensitive film or plate, and correspondingly close to the object being photographed, magnifications of several diameters can be obtained, without the use of a microscope at all. In fact, standard microscopes can be equipped with special photographic lenses which screw into the nose end of the tube in place of the regular objectives. These photographic lenses, used without an eyepiece, are similar to the lenses employed on miniature cameras.

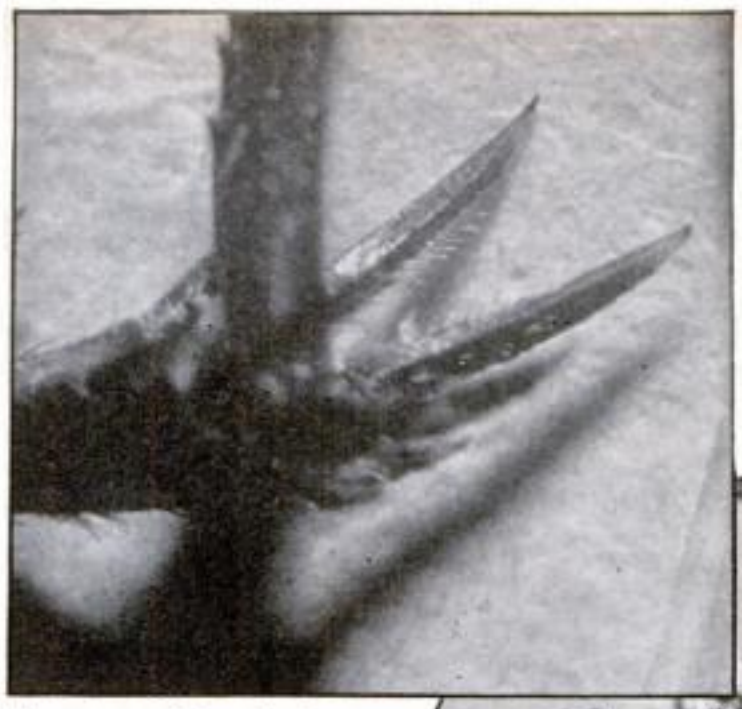
Magnification of photographic lenses used for low-power photomicrography depends on the focal length of the lens and the distance it is from the film or plate. For instance, a magnification of ten times will be obtained with a lens of sixteen-millimeter focal length placed 176 millimeters from the film, and sixteen millimeters from the object; or by a 5¼-inch photographic lens placed 1462 millimeters from the film and 132 millimeters from the object.

It is possible to make stereoscopic photomicrographs with binocular microscopes having two objectives placed side by side.

TO AVOID DIFFRACTION
Here is the way to prepare anti-haze "washers" of black paper to get the sharpest possible focus. Punch a hole in each, as above. Place it in the objective, in the manner shown at right. Don't scratch lens

Inserting a roll of dull paper into an optical tube to prevent internal reflection when no eyepiece is used

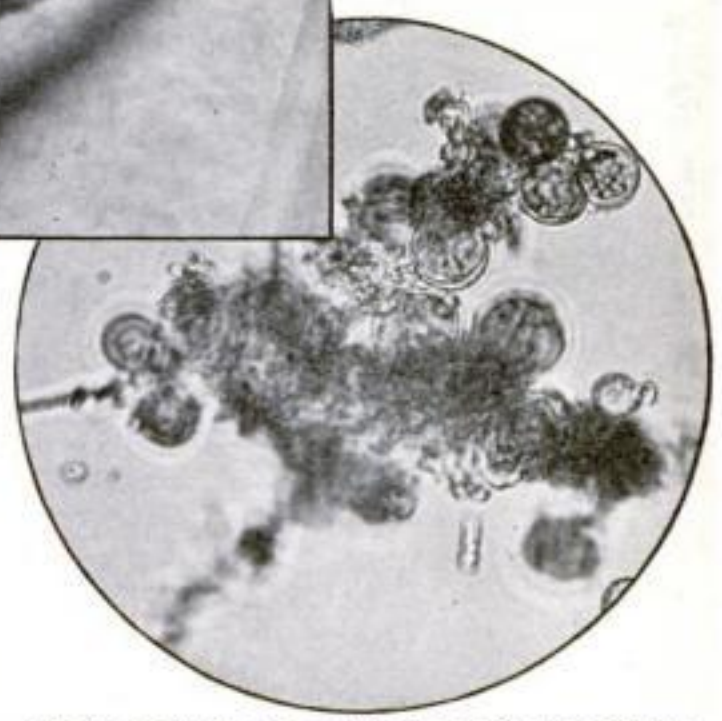




These are two low-power photomicrographs of the leg of a cricket arranged for viewing in a stereoscope. They can be used as models, to show the proper arrangement of the prints

By

MORTON C. WALLING



The effect of diffraction on the clarity of an image. Here algae and fungus are clouded by typical bands of light

However, the method to be described is for microscopes of the ordinary type, having a single objective.

To make a stereo-photomicrograph, simply make two exposures of the same object at the same magnification, on separate plates or films, moving the object to one side a slight amount between exposures. When the prints are made, they are mounted side by side in the proper sequence, and viewed through an ordinary stereoscope. Until you actually have looked at such a stereoscopic picture, you cannot imagine the marvelous sight that will greet your eyes. Details that you would not observe in an ordinary photomicrograph stand out with great prominence. An insect egg looks as if you could reach out and pick it up. The leg of a cricket becomes a real, solid, three-dimensional object furnished with claws and spines.

While the process of making such pictures is not involved, there is a number of little tricks that you can employ to make success more certain.

The distance an object must be moved depends on various things, such as the magnification, degree of stereoscopic effect desired, and so on. The best way is to measure the movement on the ground glass. It is possible to make stereo-pictures with a camera that cannot be focused directly, movement of the slide being judged by looking through the microscope; but the use of a ground-glass focusing screen is highly desirable.

The slide usually is shifted so that a single point on the object travels across the ground glass a distance of two and one-half inches, or the normal distance between human eyes. This makes it desirable to use a fairly large negative, something like four by five inches. However, excellent stereoscopic effect can be obtained in many instances with less movement. When a very small camera is used, the negatives should be enlarged, or the positive prints or transparencies viewed with the aid of a device that magnifies them.

The best plan is to use a camera large enough to permit a full shift of two and one half inches. The camera ground glass should be marked with two dots, spaced exactly two and one half inches apart, and equidistant from the center point of the focusing screen. Make one exposure with the main part of the subject under one dot, then move the slide to the right or left until the same point is beneath the other dot, and make the second picture. With a little practice you can learn to move the slide smoothly. Always move it in a direction parallel to one of the edges of the film or plate, so that less difficulty will be experienced in trimming and mounting the prints.

To produce a stereoscopic effect, the pair of prints must be mounted side by side, in proper order, and viewed with a stereoscope. If the pictures are reversed in position, the effect is confusing, the background usually appearing as if it were nearer your eyes than the object itself. The right-hand and left-hand prints can be picked out by inspection, if the entire picture area of the negative has been printed. The print to be viewed by the right eye will have more space to the right of the main detail.

Pictures intended for viewing with American-style stereoscopes usually are mounted with identical points of each image approximately three inches apart, although some authorities claim that two and one half inches is better. With the three-inch spacing, size of each picture area is about three inches square, and the field of view of the right-hand image extends about one eighth inch farther to the right than the left-hand one. If two stereoscopic photomicrographs are inverted, they must be transposed also, to preserve the three-

(Continued on page 99)

Detailed soft prints such as these make the best stereoscopic photographs. Here you are shown a sector of the balance wheel of a wrist watch, magnified only nineteen times. Contrast upper right-hand corners, for variation

PRESENTING A GROUP OF

New Tools *for*

A HANDY PORTABLE ELECTRIC RANGE

Designed for cooking anywhere that current is to be had, this range is especially useful in the sick room. However, it can cook a complete meal for a family of eight. Side stoves close flush with the sides, and the oven holds a full-size roaster. Right, range being carried

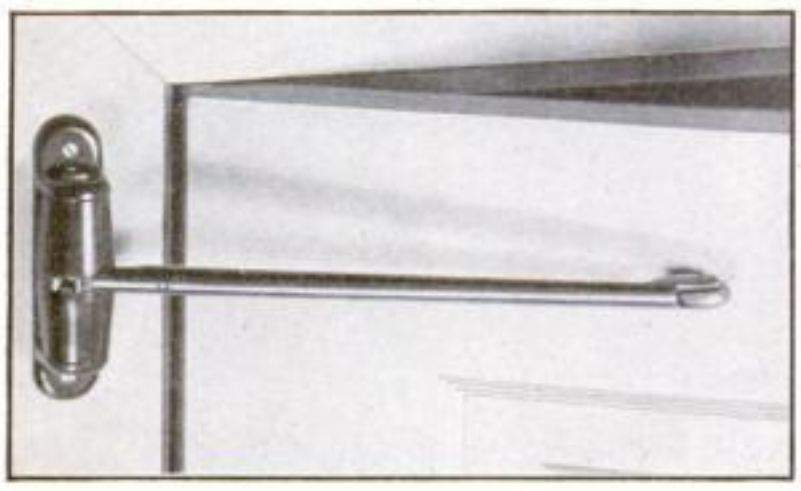
EXPANDING BOOK RACK. Made of spring steel with the ends curled in, this novel book rack expands or contracts to accommodate a varying number of volumes. The books are held erect and pressed compactly together. Rack and books are moved as a unit

DIRECT-CURRENT ELECTRIC CLOCK

Unlike most electric clocks, the one shown above operates on direct current and can be run from the house wiring or from a battery. It contains no springs, escapement, or pendulum; instead, a thermostatic device actuates the small driving magnet at intervals of one second. The clock is said to keep good time

AQUARIUM ORNAMENTS OF GLASS. The "bubblefish" pictured above are examples of a new fad of novelties for aquariums. They are suspended from realistic glass bubbles

NOVEL NUTCRACKER. The ingenious lever action of the nutcracker shown below makes it possible to crack the shell of a nut with a gentle pressure without crushing the meat. The jaws take nuts of any size



ILLUMINATED DOOR KNOB

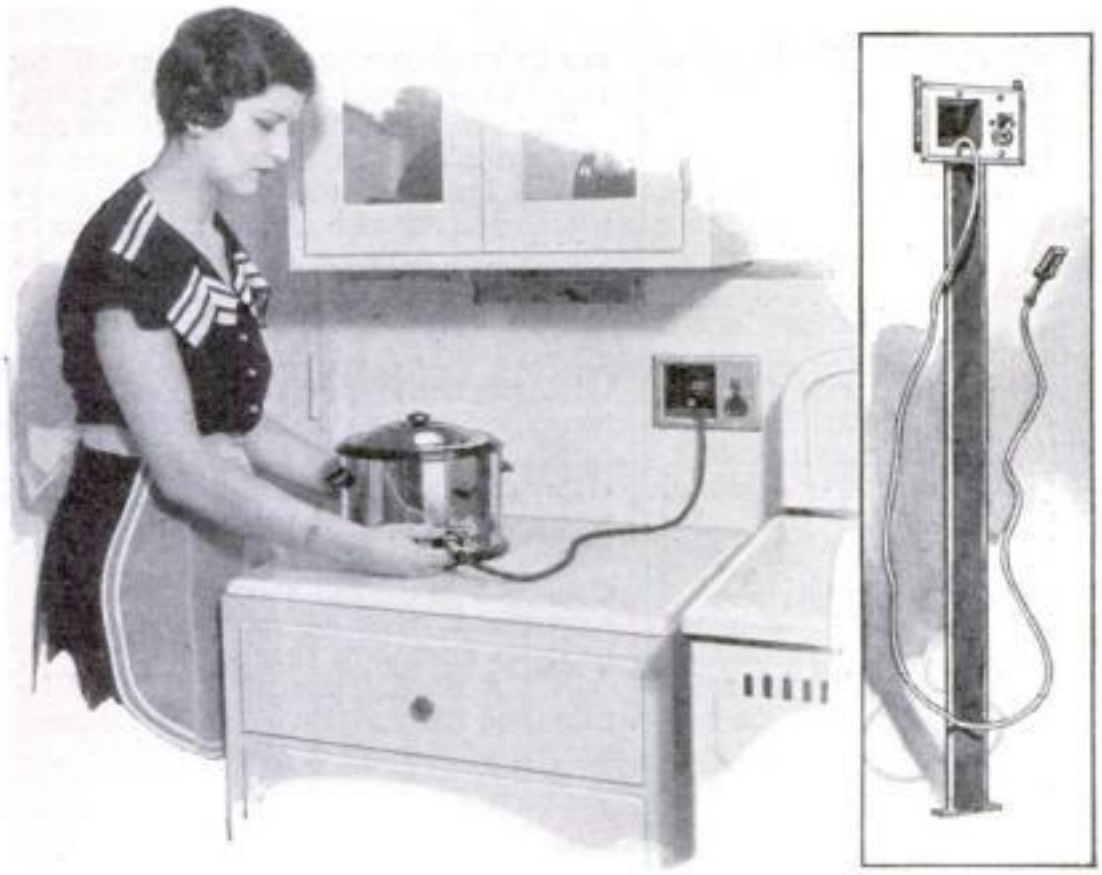
The interior of this knob assembly contains a battery, a bulb, and an automatic switch. When the knob is turned, the bulb lights. It can also be left on as a porch light to aid arriving guests

EASILY INSTALLED DOOR SPRING

Only two screws are required to install this unobtrusive door spring. When the bracket is fixed to the jamb, a rubber roller on the metal arm rides along the door without marring the paint

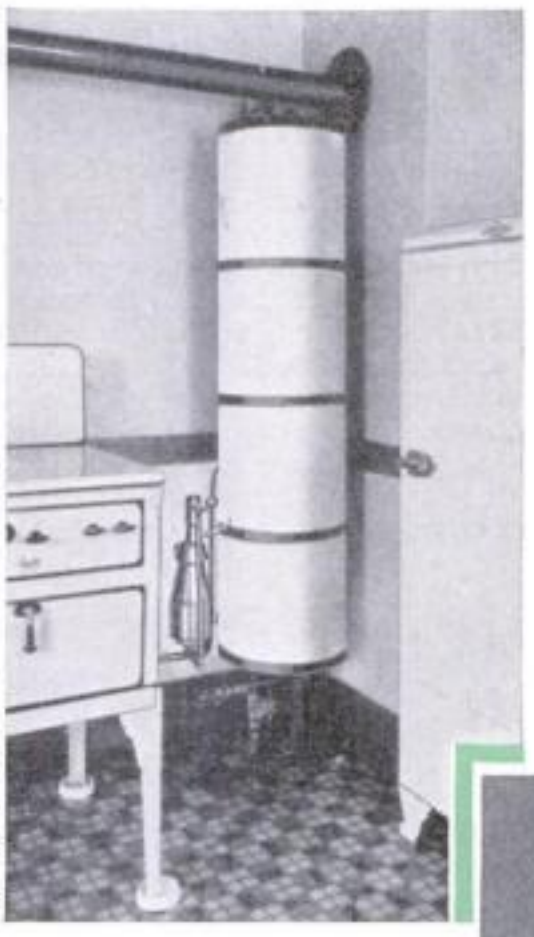
CLEVER AND CONVENIENT

the Household



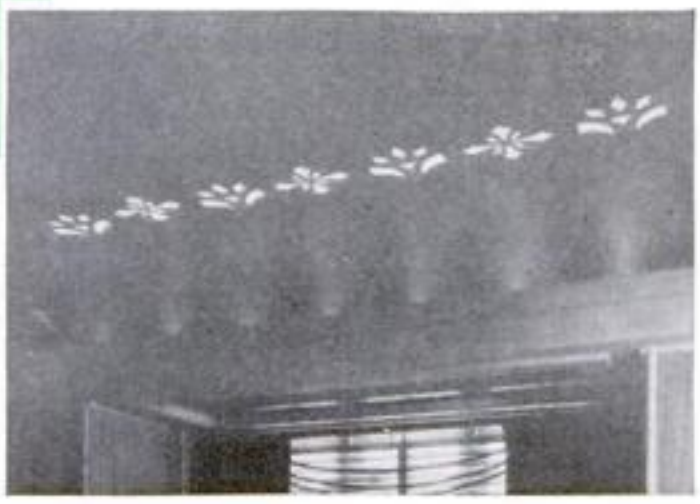
APPLIANCE CORD STORED IN WALL. This new kitchen convenience consists of six feet of electrical appliance cord suspended in a metal raceway in the wall. A gentle pull brings out the desired length of cord and it "stays put" as desired. After use, a slight push starts it feeding into the raceway by force of gravity

AWNINGS MADE OF COPPER. Above is shown a new awning of copper, which folds like a Venetian blind. Being rust-proof, it can be used in all weather without damage. It also eliminates the danger of fire from stray cigarettes



COILLESS WATER HEATER
Because it dispenses with the usual coils, this gas heater is uncommonly compact. Heat passes from the flame to the water through a radiating fin

REFRIGERATOR EGG RACK. With the handy rack illustrated above, eggs can be kept in a small space on any shelf of the refrigerator. They are kept in sight and protected from breaking



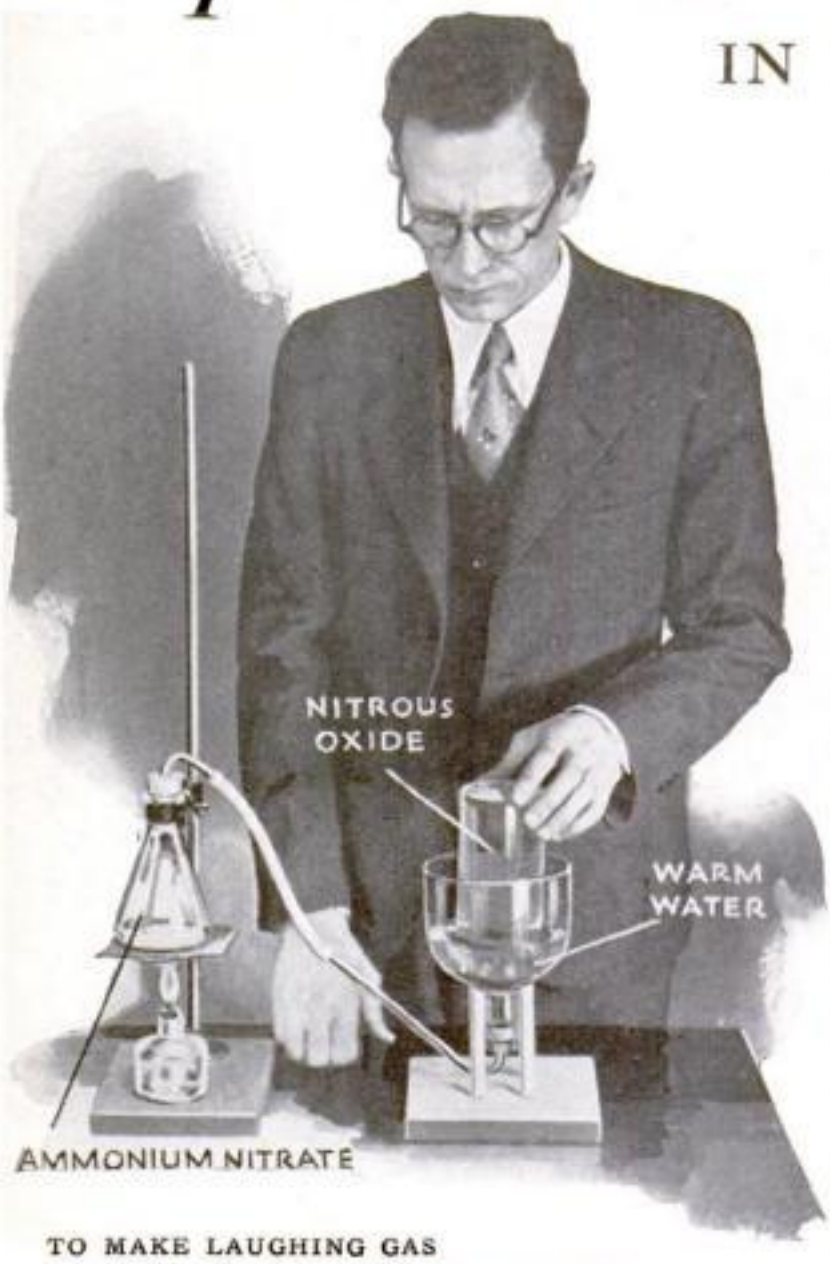
LIGHTS HELP IN DECORATION
Light bulbs concealed in recesses in the ceiling, and covered with stenciled designs as at the right, aid in carrying out decorative schemes

INGENIOUS FAUCET COUPLING. This new faucet coupling makes it easy to attach the hose of a portable shower or other appliance to any faucet, regardless of shape or size

SUCTION CUPS HOLD CLOTHESLINE
Both ends of this light clothesline are fitted with suction cups that will hold it on any smooth surface. It is designed for indoor use

Experiments with OXIDES

IN THE HOME LABORATORY



TO MAKE LAUGHING GAS

Ammonium nitrate is heated gently, as shown, in a one-hole glass flask set up over an alcohol lamp. The resultant gas, nitrous oxide, passes downward through the tubing, then upward through a pneumatic trough into an inverted glass bottle, in which it is collected for tests

IF YOU have ever taken gas while having a tooth extracted, you already have a first-hand acquaintance with nitrous oxide, or laughing gas. It is one of several oxides of nitrogen that may easily be prepared at home, with simple apparatus. Because of their importance in peace and war—in the manufacture of valuable fertilizers and potent explosives—a study of their curious properties makes a fascinating chemical pastime.

Probably one of your first chemical experiments was to manufacture hydrogen gas. The chances are that you did it by letting some acid react with a metal, such as hydrochloric or sulphuric acid with zinc, thus obtaining a copious quantity of hydrogen. Most acids and metals behave in this way, but that is no reason for concluding that they all do.

When you allow dilute nitric acid to come into contact with zinc, for example, quite another gas is produced. It will prove to be nitrous oxide, or laughing gas. Chemists now believe that a reaction like those you have observed before occurs first, producing hydrogen, and that the hydrogen then reduces, or reacts further with, the nitric acid to liberate the nitrous oxide.

There is another, more sure-fire way of obtaining nitrous oxide gas, however, that will appeal to the home experimenter. This is by gently heating ammonium nitrate, which yields an abundant supply of the gas. The operation is performed in a glass flask fitted with a one-hole stopper, carrying a bent tube that delivers the gas to a homemade pneumatic trough. The new form of trough described here will be a convenience for collecting this and other oxides of nitrogen.

The one illustrated is made by cutting apart a glass bottle and using the upper portion. To do this, scratch a mark with a file completely around the bottle where the separation is to be made. Tie a soft cotton string around the mark and moisten it with alcohol. Now set fire to the string, holding the bottle horizontally and revolving it until the flame goes out. If the bottle has failed to crack, immerse it at once in cold water, which will usually start a crack that spreads completely around the bottle. The upper portion may then be removed and its sharp edge smoothed by rubbing with abrasive stone or paper.

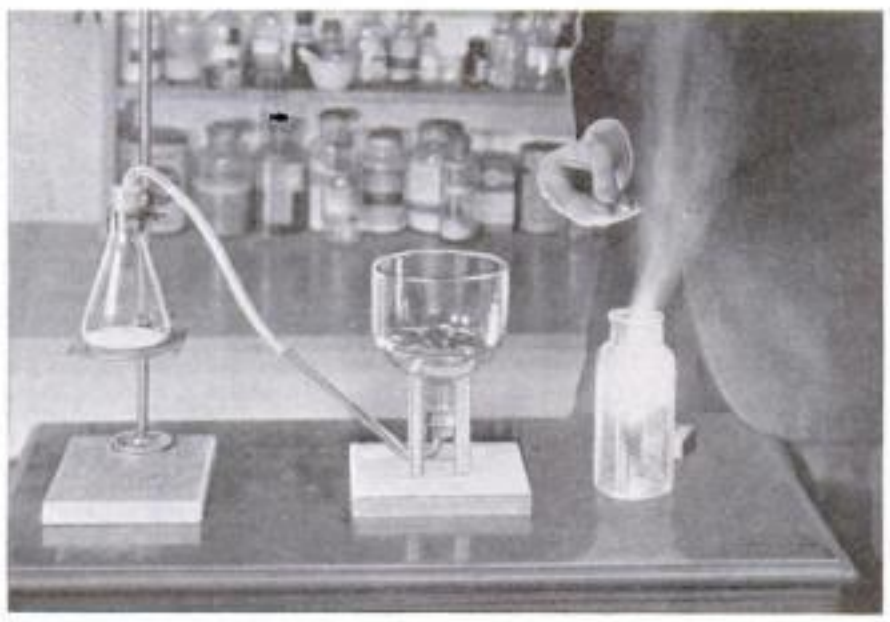
When ready for use, the upper portion is mounted upside down on four wooden pegs, such as dowel rods, fitted to a square wooden base. The mouth is fitted with a cork or rubber stopper through which a bent glass tube passes. To place this collector in operation, fill it about one-third full of water and invert a smaller bottle, completely filled with water, in this improvised basin. Bubbles of gas arising from the outlet of the bent glass tube will then be trapped in the smaller bottle, the water backing out into the larger one. The opposite end of the tube should, of course, be high enough that water will not run back out of it when the trough is filled. When the small bottle has been filled with gas, a disk of cardboard or a glass plate is submerged and slipped under the mouth, and this will serve as a temporary stopper while the sample is removed from the trough for experiment. Such a cap also can be used to keep water from spilling out of a collecting bottle being set in place.

To make nitrous oxide, place some ammonium nitrate in a flask that can be heated from beneath. An alcohol lamp provides plenty of heat. The substance in the flask first melts, and then begins to give off the nitrous oxide, or laughing gas. When bubbles are issuing in a steady stream from the end of the glass delivery tube in the pneumatic trough, remove the lamp from beneath the flask. Once started, the decomposition of the ammonium nitrate continues spontaneously, and the reaction is likely to become somewhat vigorous if not carefully controlled. An occasional "probing" with the lamp will replace heat lost from the flask by radiation; no more heat than is necessary to deliver a slow stream of gas should be used, and heating should be discontinued entirely when most of the ammonium nitrate has disappeared.

A mixture of equal parts of ammonium sulphate and sodium nitrate may be substituted for the ammonium nitrate, giving a milder but effective reaction.

WHEN you have filled several bottles with the gas, you are ready to try some interesting tests. Remove the cover of a bottle of nitrous oxide and try thrusting a glowing match stick into it. The stick rekindles itself and flares up as if the bottle contained pure oxygen. Sulphur in a deflagrating spoon, well kindled, will also blaze brilliantly. Support some burning sulphur at the end of a little bundle of iron wire, lower this into a bottle of nitrous oxide, and even the iron will burn. At high temperatures nitrous oxide decomposes and liberates the nitrogen and oxygen of which it is made. The release of the oxygen accounts for the way that the gas supports combustion.

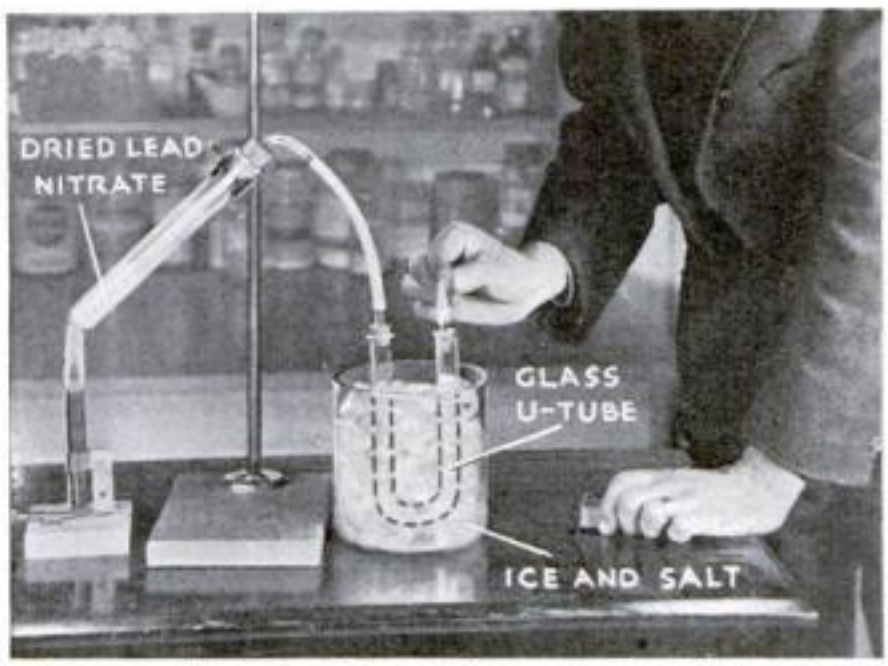
Another curious property of the gas is the mild hysteria accompanying its anesthetic properties, when breathed. This is distinctly *not* an experiment for the home



EVEN IRON WILL BURN in nitrous oxide, which supports combustion. Here the fumes that are rising from the bottle mouth denote oxidation of iron wire tipped with a bit of burning sulphur

# of NITROGEN

By RAYMOND B. WAILES



A glowing match bursts into flame, like this, when it is held over the open end of a U tube, in which liquid nitrogen peroxide is being collected. The U tube is shown packed in ice and salt, to lower the temperature of nitrogen peroxide gas produced

You can demonstrate the diffusion of gases by removing a cardboard stopper from between two bottles, one inverted upon the other. The nitric oxide in the upper bottle, being heavier, sinks, forming red nitrogen peroxide

chemist to try. "I danced about the laboratory like a madman," wrote Sir Humphrey Davy, celebrated British chemist, who inhaled sixteen quarts of the gas in one of his pioneer studies.

When nitrous oxide is prepared commercially, it is purified by bubbling it through iron sulphate solution. This removes other oxides of nitrogen that may be present if too high a temperature is used in preparation. The gas is also passed through potassium hydroxide (caustic potash) solution to remove any chlorine gas that may have been produced by impurities in the ammonium nitrate.

Nitrous oxide contains two part of nitrogen and one of oxygen. Another oxide of nitrogen known as nitric oxide, containing one part each of nitrogen and oxygen, is also easy to produce in a home laboratory, through the interaction of copper and dilute nitric acid.

Prepare the acid by mixing one part of strong, or concentrated, nitric acid with four or five parts by volume of water. This may be placed in an ordinary Erlenmeyer or Florence flask, together with bits of copper sheet or wire, and heated. The gas that is evolved is collected in the pneumatic trough, as in the preparation of nitrous oxide.

When the flask is heated, its upper part becomes filled with a reddish vapor. The acid-copper mixture is producing colorless nitric oxide gas, but the nitric oxide immediately combines with the air in the flask to form another oxide of nitrogen, known as nitrogen peroxide. Soon this reddish gas is swept out of the flask by the fresh nitric oxide being produced. An inverted bottle full of water may then be placed in the pneumatic trough to collect the nitric oxide.

An alternative way of preparing nitric oxide is to fit a flask with a two-hole stopper, carrying the gas delivery tube and a separatory funnel. The latter is filled with strong sulphuric acid. With the aid of the stopcock on the funnel, acid is allowed to fall, a drop at a time, into the flask, which contains a layer of copper metal covered with a strong solution of potassium or sodium nitrate. In this action, nitric acid is first formed, and this reacts with the copper to liberate nitric oxide.

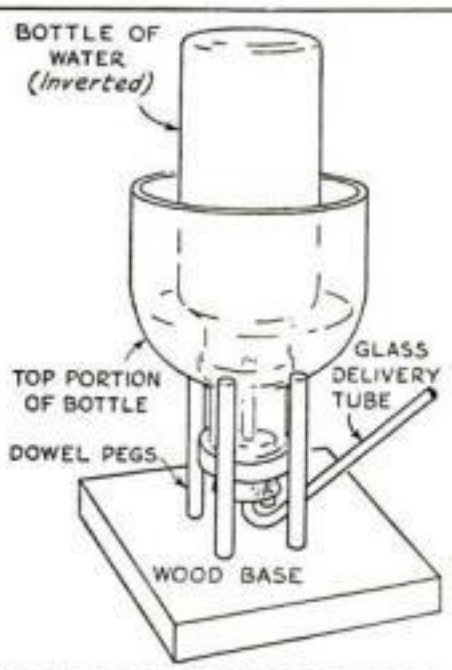
When the cover is removed from a bottle of nitric oxide, the reddish gas, nitrogen peroxide, is formed. A striking demonstration consists of placing a bottle of nitric oxide over a bottle of air, mouth to mouth, and sliding out the paper or cardboard cap of the former. Nitric oxide in the upper bottle, being heavier than air, will diffuse into the lower one, and the resulting reddish vapor demonstrates nicely the phenomenon of the diffusion of gases.

No gas except nitric oxide produces a red gas when it comes in contact with air. The ancients gave it the fanciful name of "the blood of the salamander" to describe this unique property. Because of its immediate transformation into the peroxide when exposed to air, it is impossible to describe the odor of nitric oxide or its physiological effects. Its chemical reactions, however, are readily contrasted with those of nitrous oxide, which you previously observed.

Glowing matches or brightly burning sulphur, lowered into bottles of nitric oxide, are extinguished. Although the gas contains twice as much oxygen as nitrous oxide, it parts with its oxygen reluctantly. The air, which is only one fifth oxygen by volume, supports combustion far better because the oxygen is simply mixed, instead of being locked in chemical combination with the other ingredients.

Nitric oxide dissolves in a solution of iron sulphate (ferrous sulphate), as you can demonstrate by inverting a bottle of the gas in a water solution of the chemical. The solution rises into the bottle, and becomes deeply colored by the formation of a complex compound as a result of interaction between the nitric oxide and the ferrous sulphate.

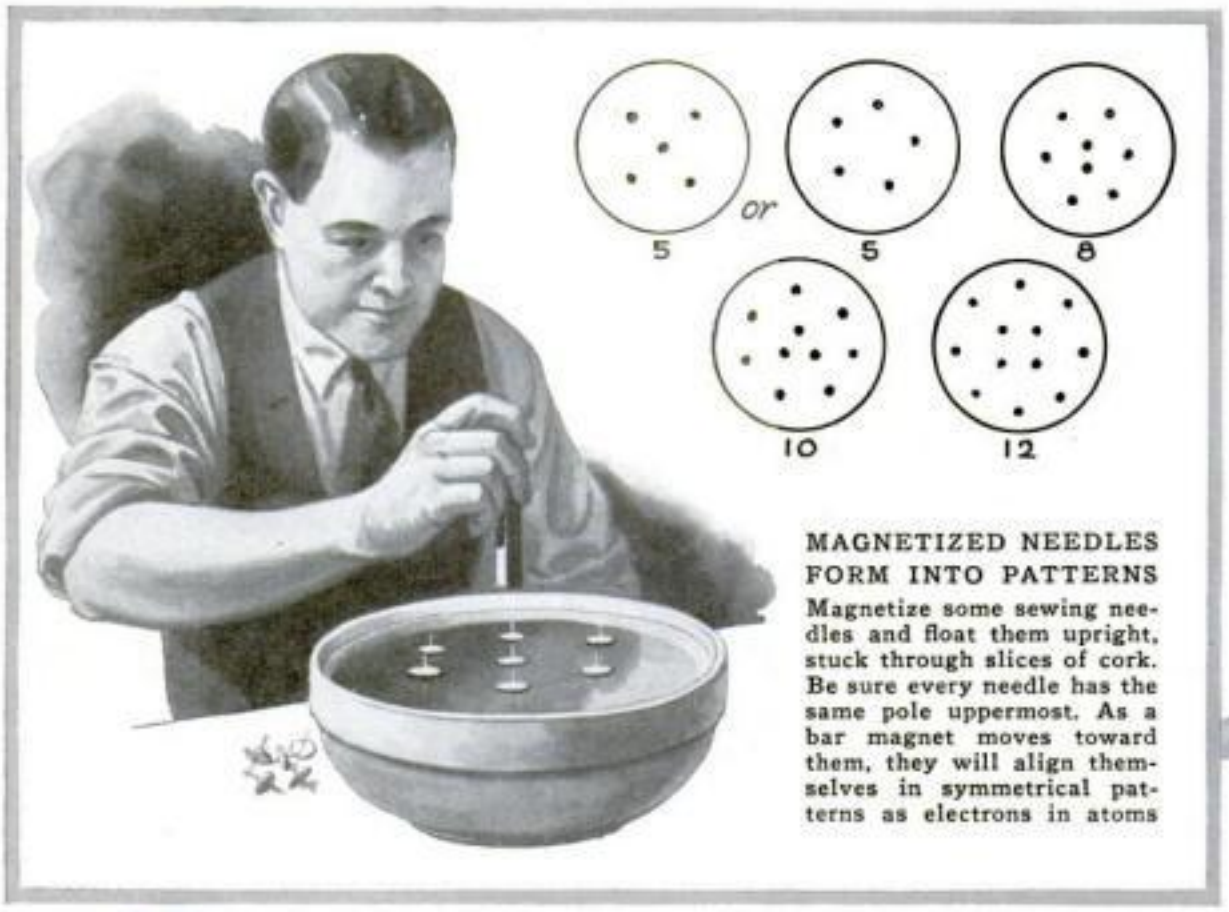
Nitrogen peroxide, the reddish gas, may be made directly by heating lead nitrate in a test tube. The chemical decomposes and gives off the peroxide gas, together with oxygen. By leading the vapors through a glass U tube packed in ice and salt, the nitrogen peroxide may be condensed to a yellowish fluid, for at such low temperatures it is a liquid instead of a gas. When this liquid is poured over cracked ice, a *(Continued on page 109)*



APPARATUS IN WHICH YOU CAN GATHER NITROGEN OXIDES

To make this simple pneumatic trough, tie a soft cotton string soaked in alcohol around a large glass bottle. Set fire to the string. Remove the upper portion of the bottle, invert it and set it upon legs, as shown here. Fix glass delivery tube in cork. Fill basin one third full of water; invert small bottle, full, in it

Easy Scientific Experiments



MAGNETIZED NEEDLES FORM INTO PATTERNS

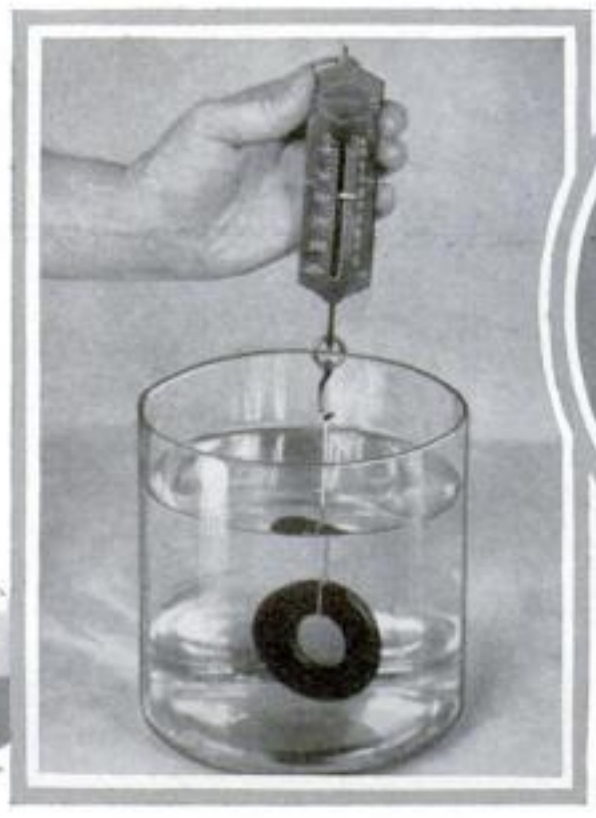
Magnetize some sewing needles and float them upright, stuck through slices of cork. Be sure every needle has the same pole uppermost. As a bar magnet moves toward them, they will align themselves in symmetrical patterns as electrons in atoms

MICA CAUSES YELLOW FLAME TO HAVE BANDS

Borax placed on a wire held in a Bunsen flame emits monochromatic yellow. Look at it through bent mica. You will see light and dark bands caused by interference of light waves reflected from both sides, extinguishing each other as they meet. The result of the collisions is visible as strips of blackness

SMOKE-RING MAKER PUTS OUT A CANDLE

Tapping the cloth or paper drumhead of a smoke-filled carton drives a smoke ring out of one-inch hole in the remaining end. If directed at a candle flame, the ring will smother it, as if by a forceful breath, even from a distance of seven feet



TOP PROVES CURRENT FLICKERS

Alternating-current lights flicker constantly. You cannot see the flickers, but this top will convince you they occur. It is made of cardboard and marked with eight alternating black and white sectors. Its peg is a pencil. If you have sixty-cycle A.C., the top will appear motionless at a speed of thirty revolutions per second, and its design will become distinct

BITS OF PAPER DANCE AS SILK RUBS GLASS

Into a tin can lid put small pieces of tissue paper. Then cover the lid with a sheet of glass. Using silk, rub the glass vigorously for a moment. Static electricity will make the paper bits dance back and forth between glass and tin

SPECIFIC GRAVITY CAN BE FOUND IN THIS WAY

The ratio of the weight of a substance to the weight of an equal volume of water is the specific gravity of the substance. Take the weight of a piece of iron in pounds. Immerse the iron in water as shown above, and weigh anew. Divide the second weight by the first. Your result will show iron more than seven times the heavier

SINGING FORK TESTS RESONANCE OF AIR

A vibrating fork will sing its loudest over the neck of an olive bottle, when the air column within the bottle is in resonance with it. In picture at the right, water is being poured into the bottle while the fork is vibrating. With care, the sound made by the fork can be adjusted delicately at its greatest clarity and vividness

AMATEUR MECHANICS CLEAN UP IN

New Gold Rush

One of the more complete amateur mining rigs of the 1935 gold rush. A belt conveyor disposes of the waste

By
STERLING GLEASON

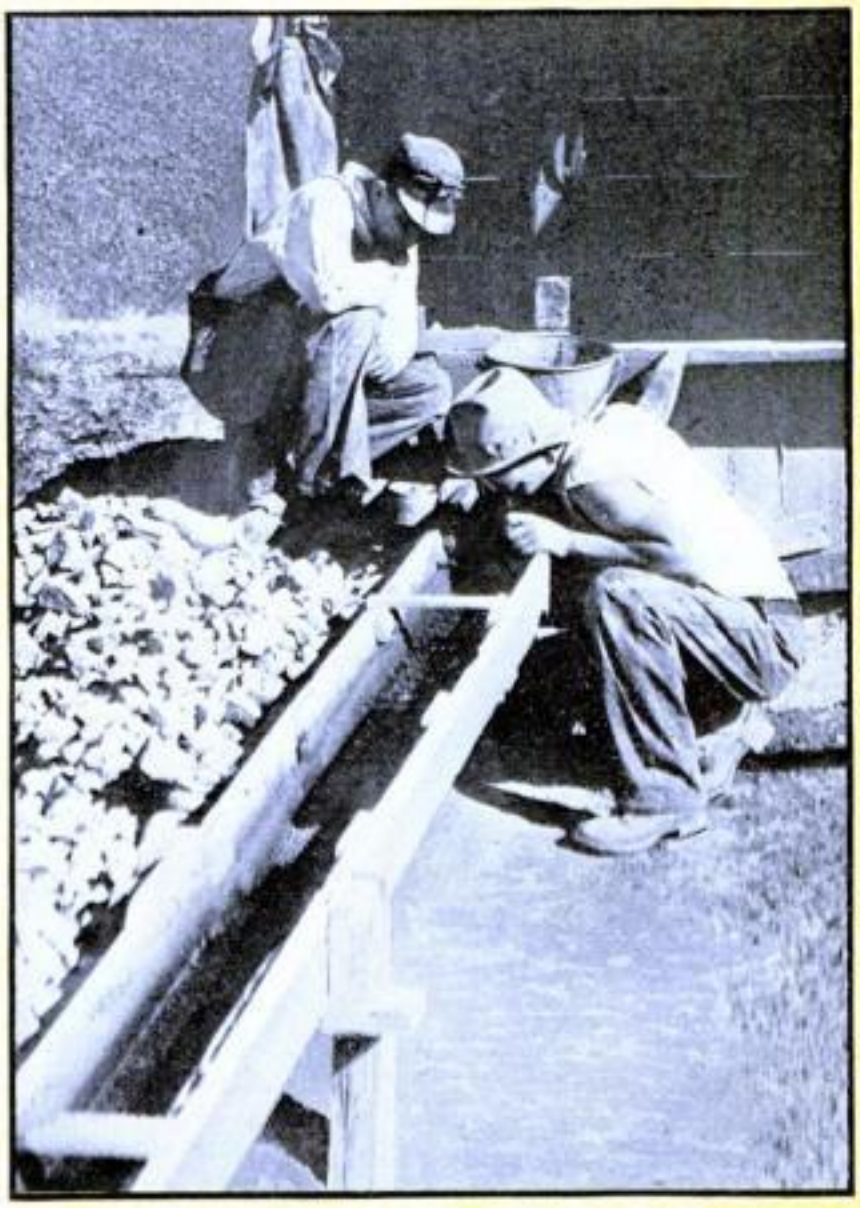
BY UPHOLDING $35-an-ounce gold, the recent decision of the Supreme Court has started a new gold rush and amateur mechanics are leading the way. Men who are handy with tools, have a little money to start on, and know something of prospecting, are now building novel mechanical mining plants that will turn their labors into cash.

Already, many of the bleak hills of western mining centers look as if monster gophers have been at work. Hoist and gallows frames, improvised from old lumber and junk, spot the skyline. In many crowded canyons the air resounds with the putt-putt of gasoline engines as ancient automobiles lend their power to grind rocks and free its gold.

Mechanical mines are the secret of the 1935 gold rush. With the assured high price of gold, every shovel-full is worth almost double what it was a few years ago. Build a machine to handle it faster, and you open up alluring new chances for profit. Men of the new gold rush are robbing junk yards and rummaging through scrap heaps to build mechanical hoists, crushers, washing and rock-breaking equipment in which a second-hand automobile usually plays a central part.

Unlike the greenhorns who have swarmed in droves to the gold camps in the hope of making a fortune with pick and shovel, many of these more experienced men are finding mining a profitable business. Just the other day, a fortune was tossed into the lap of a thirty-two-year-old miner who made what experts call the biggest strike in half a century. Since 1933, he had been quietly tracing an outcrop that led to a gradually unfolding vein of ore. Two younger men helped him trace the ledge and do the cruel, back-breaking work of digging under a blistering sun. For this each received a twenty-percent interest in the mine.

Discouraged, the two young associates soon sold out their shares piecemeal for a total of $1,500. But the mine grew richer as it was explored and suddenly showed a dazzlingly rich vein, now known to be at least 350 feet deep with bottom



Two modern Forty-Niners at the sluice box of a mine. Several large nuggets of almost pure gold have been taken from this box recently. A plentiful supply of water is almost essential

Amateur miners building a complete plant for handling placer gravel, using the engine of an old automobile as their source of power. The radiator and steering wheel can be seen

yet untouched. As news of the strike spread, the owner refused $10,000 for his claim, and offers began to mount—$75,000, $250,000, $300,000, $500,000, $750,000, and on upward, until finally a South African company was granted an option for the reported sum of $3,500,000.

As I peered down into murky shafts or walked gingerly into damp tunnels to glean the wisdom of bronzed, overalled miners, I heard tales which indicate two new phases in the gold rush of 1935. One is the way little groups of jobless men are pooling their slender resources, forming coöperative societies for the purpose of minting their labor into money.

The other is the ingenious and often amusing way in which antiquated automobiles and machinery salvaged from the junk pile are being converted into homemade milling equipment to mechanize their pick-and-shovel mines.

Coöperation and ingenuity take the place of capital with these little groups of amateur miners. Three Arizona policemen, dropped when city officials cut the budget, formed a small mutual company and began working a claim by hand. Their earnings enabled them to install machinery which will greatly increase their output.

Ten men formed another partnership and sank a seventy-foot shaft along an outcrop. The vein gradually widened and showed good values in gold, silver, and copper. Their success enabled the men to install first a power hoist and later a fully equipped blacksmith shop in which to sharpen tools. Next will come a stamp mill, as, little by little, they build a fortune from their slender stake.

The successful amateur miner of 1935 uses homemade machinery to get more dirt through his plant. Experience has taught him the weaknesses of his simple equipment and he has rebuilt it to greater efficiency. Instead of working singly, three to six men pool their resources to form a coöperative company. Having located a promising claim, they obtain a lease from the owner, agreeing to pay a royalty of ten percent to fifty percent of the gold, depending upon the richness of the property. Then they combine efforts to rig up machinery and sink a shaft to the vein.

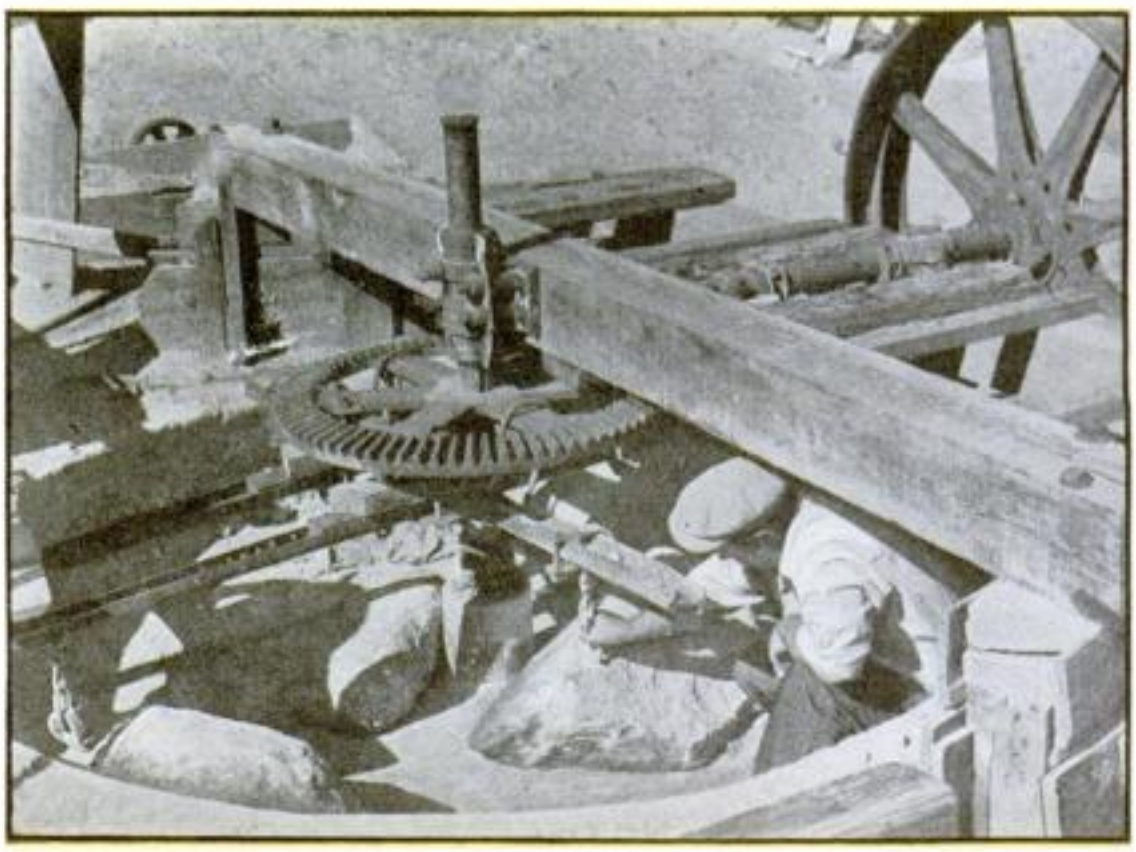
An automobile engine will power a hoist to bring ore to the surface, and also may operate a pump to keep the mine dry. If the operators can afford it, they will add a compressor to run a rock-breaking drill. Dynamite, thriftily placed, shatters the harder formations. If the tunnel is horizontal, ore may be trundled out in wheelbarrows or homemade ore cars. Some fortunate miners have ore so rich it can be loaded directly aboard railroad cars for shipment to the smelter. Others, handicapped by greater shipping distance or by low-grade ore, must mill it to remove waste rock and send only the concentrate to the smelter for final treatment.

Old, primitive equipment left by early-day prospectors is not scorned by the newcomers but often is pressed into service beside modern machinery. Many mines still have their old arrastras—burro-driven crushing mills in which triangular stones are dragged around in a saucer-shaped rock basin until the ore is pulverized. The mud and sand are washed away by running water, while the gold sinks to a groove in the bottom.

These crude devices frequently are hitched to automobile engines, which whirl

The windlass behind the sluice box in this picture is the "skip" of the mine and brings up pay dirt from the shaft

An old arrastra of early mining days, formerly turned by a burro. Now it spins rapidly under gasoline power, whirling heavy stones to crush the gold-bearing ore so the precious metal can be separated from it



the stones around far more rapidly. One mill uses four 300-pound stones attached to a great wooden wheel, which in turn is mounted vertically on an old motor-truck axle and is turned eight times a minute by a gasoline engine. Ore is dumped in, a sack at a time, and passes through at the rate of about 700 pounds daily. In "cleaning up", the owner uses a rocker containing a mercury plate, to pick up the gold. Strangely, he gets out more mercury than he puts in, for the ore also contains cinnabar, mercury in its native form.

An inquisitive man dug up the stones with which an old arrastra was lined and from beneath them salvaged gold-and-mercury amalgam left by former operators. Another man, a raw tenderfoot, took over an abandoned mine and explored a porphyry dike in which he found a couple of pockets of high-grade ore. In two "clean-ups" he took out more than a hundred ounces of gold, a small fortune at present prices.

The secret of profitable mining, I was told, lies in handling large quantities of earth cheaply. This fact has proved a disappointment to many tyros who failed to realize just what a back-breaking job placer mining can be. Much of the gold is down below deposits of boulders, some so large that tackle must be used to hoist them out. The old diggings are often bordered by high piles of large rocks, which offer a severe handicap to the modern miner.

J. B. Emberly of Phoenix has simplified earth-moving by making a portable mining plant, fed by a traveling power shovel mounted on tractor treads. With it, three men handle twenty-five to forty tons of gravel an hour.

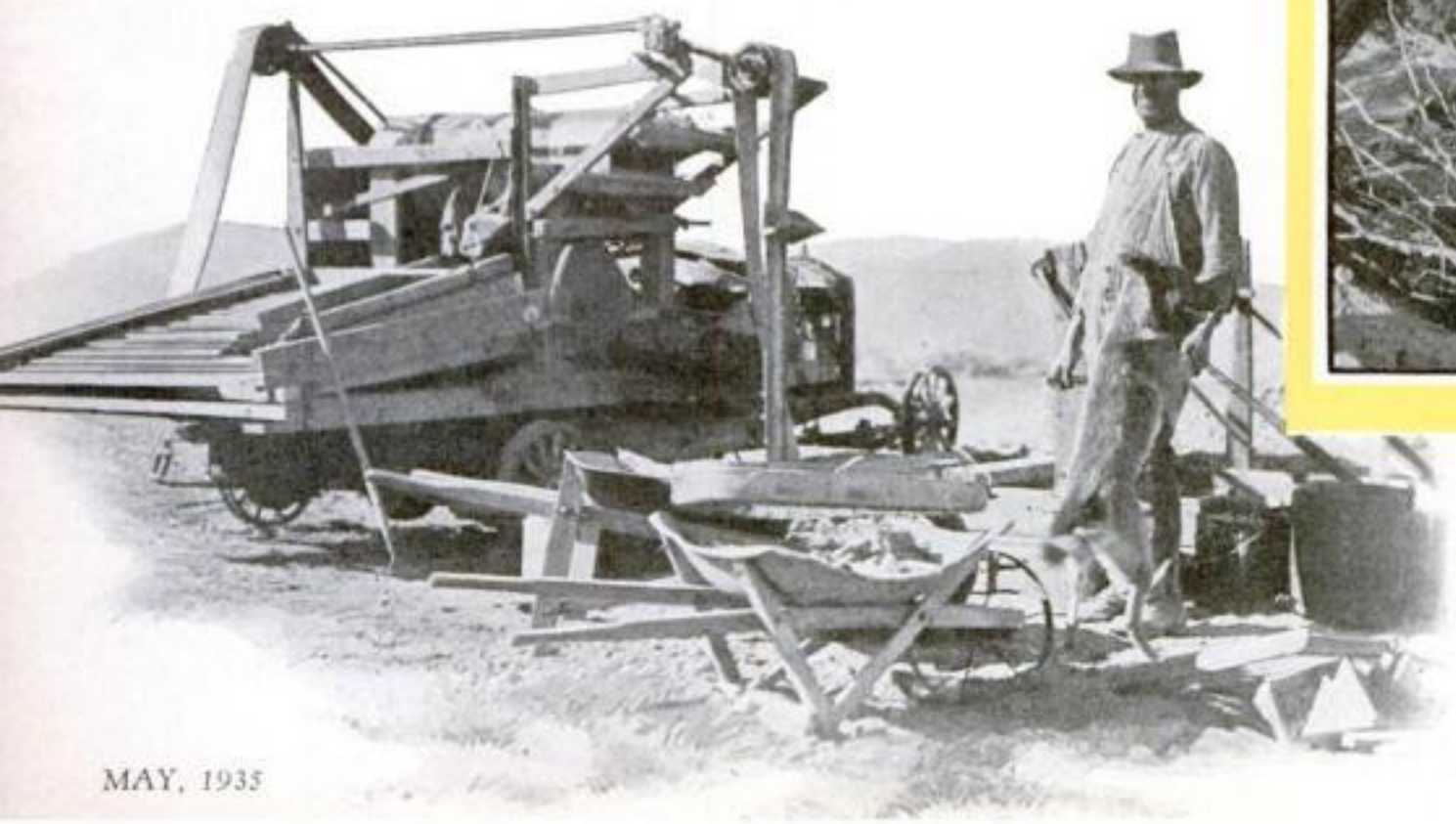
To save labor, skillful miners break down the rock in the tunnels and pick out the high-grade ore like raisins from a pudding, leaving the low-grade and worthless rock behind to strengthen the tunnel. In these shoe-string mines, where no money is available for timbering, the danger of cave-ins is ever present. Some of these burrows tunnel as much as 3,000 feet in gravelly formations with nothing save the rock's own adhesive strength to hold up the roof. Another problem is the danger of fumes in long, unventilated tunnels. One group of miners tried to use a small gasoline engine to pump out the water, but the contour of the canyon, plus the difference in temperature inside and out, prevented the heavy exhaust gases from rising in the ventilating shafts they had driven down from above.

Old mines now being reopened often must be pumped dry before work can go ahead. Water may continue to flow from subterranean sources, making mining a continual race against flood. Water is both a nuisance and a necessity in mining. In one big Arizona mine it had to be lifted at the rate of 1,000,000 tons a month. For every ton of ore hoisted, sixty-eight tons of water had to be pumped out. Yet, in milling the ore, a plentiful water supply is essential, for often from one to six tons of water are required for every ton of ore processed. Many a mine supplies its own water for milling.

Various companies are manufacturing patented mining machines—light and portable, yet efficient enough to make lean ore profitable. More than a dozen men recently organized an expedition which left Los Angeles for placers at the mouth of the Grand Canyon. A caravan of trucks carried more than 1,000 feet of pipe, which they used to convey water to the scene of operations. In this outdoor laboratory, they tested a number of different types of mining machinery and gold-recovery equipment to check its efficiency in actual operation.

A mechanized wet washer run by a gasoline motor. The scene is in Goler Canyon, Calif., one of the famous old gold-rush districts

Below is seen a complete mining mill built upon the chassis of an old car. The owner says, "Dirt goes in, and gold comes out—maybe"



A miner emerging from the shaft of a small mine. With little money available for timbering and for pumping and ventilating equipment, the miners risk cave-ins, flooding, and exhaust fumes

An automobile-powered dragline used to handle gravel in large quantities at a small mine located at Summit Diggings, Calif.

One ambitious machine was invented by a Phoenix engineer who feeds his screened material into a revolving barrel like that of a cement mixer. Gold, being heavier, is swung toward the outside of the barrel, there to be caught by a collecting cushion, which is cleaned up once a day. It handles 500 cubic yards at a shift and is fed economically by a power shovel at an estimated cost of about 15¢ a yard.

A mining engineer has invented a new mill for grinding gold ore. Weighing only 2,500 pounds, it has three revolving hammers which deliver a 5,000-pound blow when the machine is running at full speed, and is said to powder more than eight tons of ore an hour.

In another small recovery machine, run by a gasoline engine, centrifugal force throws gold and the heavy black sand into cast-iron riffles on the sides of a revolving drum, while light refuse material passes on through.

Gravity does most of the work in one midget mine, where the two partners have made operations almost automatic through clever arrangement of their homemade equipment. On the rim of a gully they have built an ore bin, which they keep full by taking turns with wheelbarrow and shovel. From the bin, gravity carries the material down a chute to a coarse screen, which discards coarse stuff while letting the finer dirt fall into a ditch full of running water. The current delivers its burden to a little ball mill, in which rotating pebbles pound the gravel to gold-bearing mud, ready to be amalgamated and smelted.

The two partners, one of whom left a good job in an assay office to join in buying a long strip of gully below the old Comstock dumps, manage to put ten tons of material through their mill every day. The ore is worth about $3.50 a ton, and they have 120,000 tons of it in sight —a twenty-year job.

Typical of the aspirations of these men is the case of Loeffler Palmer, who for seventeen years has been running a one-man gold mine in Utah. He located a number of claims, and, on the most promising, sank a shaft through seven feet

In the desert, where water is scarce, miners use dry washers like the one shown above. Below, an old drain pipe gives ventilation to tunnels radiating from the shaft beneath

of gravel into a gold-bearing vein. With what money he had, he bought a two-horsepower gasoline motor, using it to run a hoist for lifting dirt. Down forty-eight feet, he began to tunnel along a high-grade vein.

His luck held and the vein grew richer. His earnings he plowed back into his business, buying an air compressor and pneumatic drills. At times he would hire one or two men to help him. The ore, hoisted to the surface by a windlass, was loaded into trucks, hauled a mile and a half to the railroad, and shoveled into box cars.

In a representative summer's work, Palmer shipped three cars of ore, netting $13,431.29 after paying freight and smelter charges. He hired two men to help him, and his production cost, including labor, materials, and trucking, was $1,321.67.

His ore, of course, is high-grade—far too valuable to be left to the hands of others. He must superintend the work himself, for "high-grading" is by no means a lost art, and odd pieces of "jewelry rock," carried off in the pockets of miners, would subtract largely from these attractive profits.

The mine has given him a steady job, with no end yet in sight. It has proved depression-proof, and the recent increase in gold prices will represent about fifty percent clear profit in addition.

Such one-man industries represent the goal of the prospectors of 1935. A man can be his own boss and make a living, with a sporting chance of a fortune. That is the keynote of this latest, slow-motion gold rush, yet, to describe it as a slow-motion proposition perhaps is going just a bit too far.

In contrast with the fervor and exertions of the old gold rush, this one is, doubtless, a good deal milder. But the speed with which mechanical ingenuity is put to work gathering, pulverizing and assorting ores is indeed remarkable. It is to be noted that many who lack academic training in mining engineering have proved highly efficient in contriving and building mining machinery that works well, and gets very good results.

New Process Makes Sculpture Easy

Above, three accurately detailed, realistic plastic portraits made by the new process directly from the faces of living persons, in three finishes: bronze, copper, and marble

Applying the new plastic substance to the face of a man who continues to smoke during the process. With brushes of various sizes the substance, which is perfumed, is applied until it is thick enough. It is then removed and prepared for the next step of casting in plaster

Below, making an exact duplicate of a subject's head. Here plaster is being poured into the negative mask, supported by a wire cage, and laid horizontally in a large pan

Below, holding a mask just removed from a subject, is the inventor of the new process, Miss Harriet Meyer. Note the peculiar illusion created in the picture by the mask itself. Although the inside of it is held toward the camera, it appears now convex, now concave, because of its rich details

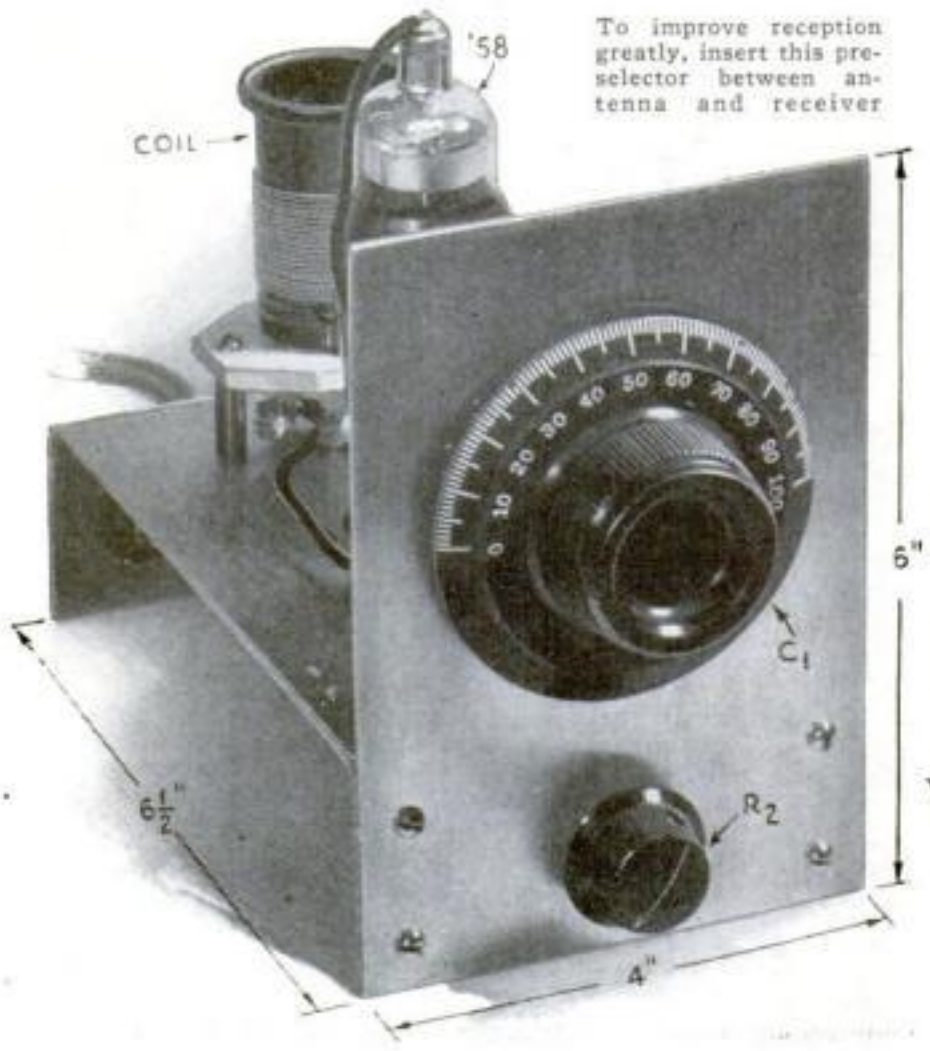
A malleable brass cage is shown fitted over a subject's face. This cage supports the plastic substance so it will not break when it is removed

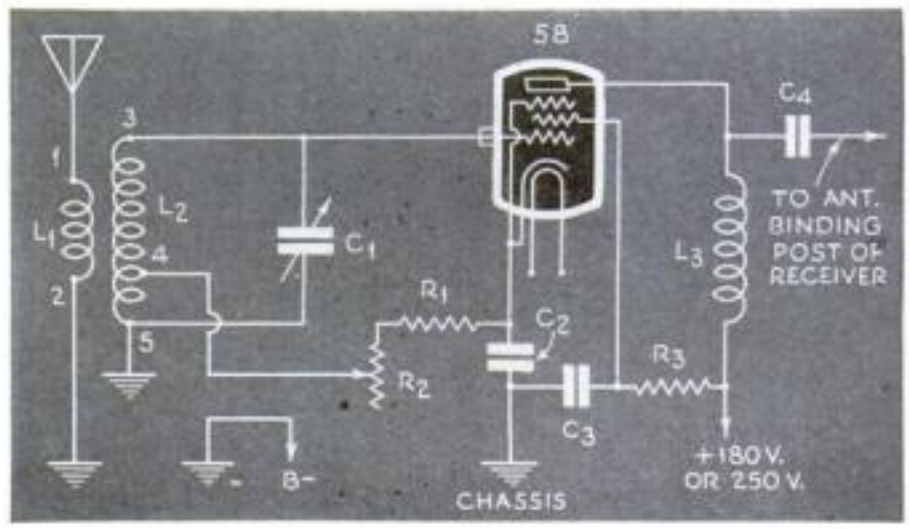
Note the striking likeness between the mask and the face in the comparison of the two, below

THROUGH a process of "plastic portraiture" recently devised by a New York college girl, a person may obtain a sculptured likeness of himself with scarcely more trouble than would be involved in having his picture taken. The secret of the method is a soft, creamy preparation that permits making an impression of the face with such fidelity that even single strands of hair are reproduced. This preparation, pleasantly perfumed, is applied while warm and is said to cause no inconvenience to the subject, who may even smoke, if he desires, during the first stages of the operation. After the face has been completely covered, the plastic impression, supported by a wire framework embedded in it, is gently lifted away and used as a mold for producing a likeness of the head in any desired finish. If preferred, the face section alone may be used, giving a decorative plaque that may be painted in natural colors and hung on a wall. A subject may assume any characteristic pose, even smiling or laughing.

Short-Wave Preselector

IS INEXPENSIVE AND EASY TO BUILD





The circuit is extremely simple. Total cost of parts is less than five dollars

By
J. A. WORCESTER JR.

HERE is a unit that will improve any short-wave set. It is a radio-frequency preselector that costs less than $5 for parts and is so simple to construct that even an inexperienced beginner can be assured of good results. When used with a short-wave superheterodyne it eliminates undesirable image interference and increases sensitivity; connecting it into the lead-in of a simple regenerative receiver materially increases both sensitivity and selectivity.

The construction of the circuit is simplicity itself. A strip of fourteen-gauge aluminum, sixteen inches long and four inches wide, cut in two, serves as the material for the chassis and panel. The chassis should be bent in a vise to form a one- and three-quarter-inch channel and the panel fastened to it with four screws.

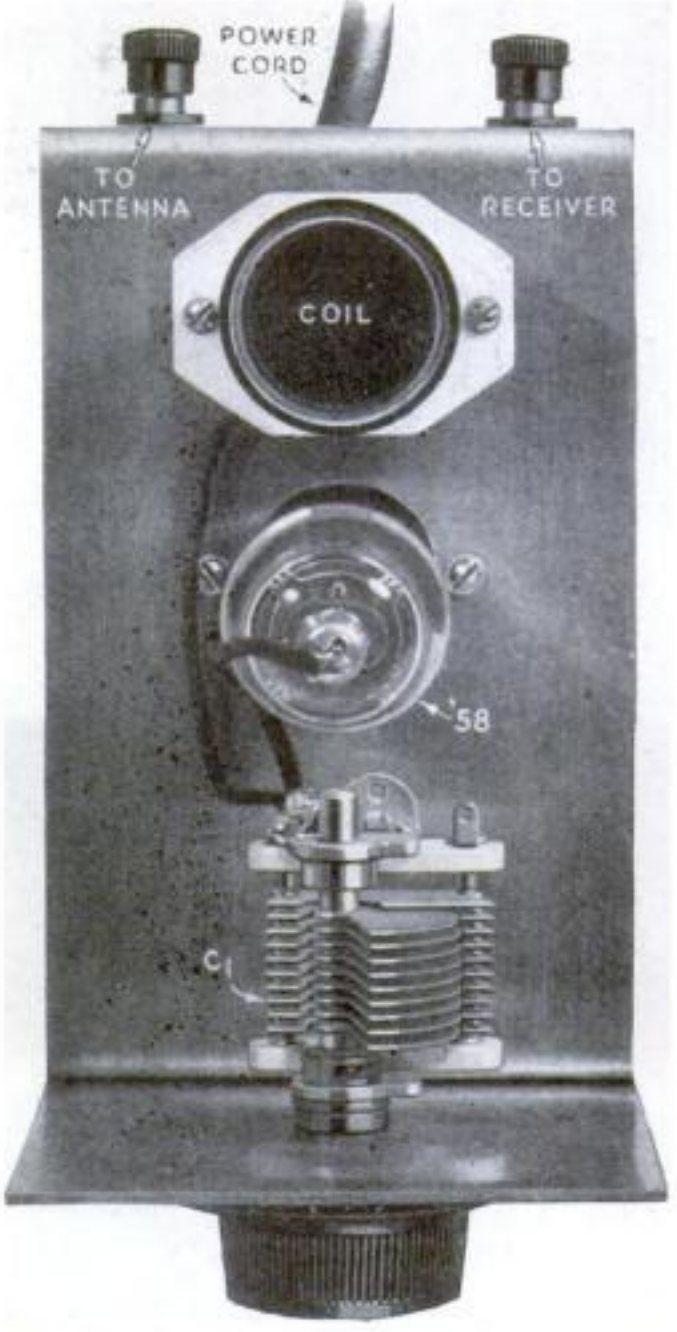
On the front panel are mounted the variable tuning condenser and the 10,000-ohm regeneration control. Although a simple three-inch dial was used for the tuning condenser in the original, a more pretentious vernier drive dial can be substituted if desired.

In preparing the chassis, the large one- and one-quarter-inch hole for the tube socket should be drilled first. If a circle cutter is not available, the more laborious method of drilling a large number of small holes around the desired periphery can be resorted to. Another alternate procedure is to drill only six holes to accommodate the six tube prongs. If this is done, however, be sure to make the holes large enough to provide ample clearance. The isolantite socket for the coil is mounted above the chassis at the rear by means of bushings supplied for the purpose; one centrally located hole drilled under the socket serves to take the socket wiring.

At the rear of the chassis are two binding posts. These must be insulated from the chassis with fiber washers—and serve as connectors to the antenna and antenna post of the receiver. A hole also at the rear of the chassis provides an exit for the power choke.

Although commercial plug-in coils can be used, they must be altered slightly to introduce regeneration. For those who prefer to wind their own coils on one- and one-quarter-inch, five-prong forms, the winding data is given in the accompanying table. On commercial coils, two of the prongs must be connected internally. However, for an initial test of the preselector's operation, these coils can be used in their original form, supplying a typical non-regenerative circuit. Then, when it has been determined that the preselector is functioning properly, the internal strap connection can be cut, the wire removed from the prong, a small hole drilled a few turns from the top of the coil winding (as specified in the table), and the tap connection made to this additional prong introducing regeneration.

When wiring the preselector, the constructor should follow as closely as possible the arrangement of the parts used in the original unit. The total number of leads required is surprisingly small and the entire wiring operation should not take longer than a half hour.



Top view. Arrange all parts carefully as shown here

To make the design general, the circuit has been constructed for use with an external power supply. If the receiver is a home-built affair, a suitable external source of power is no doubt readily available. When a commercially built receiver, having a built-in power supply, is used, it will be necessary to probe into the interior of the set to make the proper connections. If a separate supply is used, connect the B terminal of this supply to the B terminal of the receiver's supply or to its chassis.

In the original circuit shown, a type '58 pentode is used. This tube requires a two- and one-half-volt heater voltage which is the value commonly used in A.C. receivers. If the receiver employs six-volt tubes, a 6D6 or a '78 may be substituted for the '58, while for battery-operated receivers using two-volt tubes, a type '34 tube can be used, although some wiring changes will be necessary.

After making the power-supply connections, it is necessary merely to transfer the antenna from the receiver to the input binding post on the preselector and to connect the output terminal of the preselector to the antenna binding post of the receiver. This last connection should be as short as possible to minimize unnecessary signal pick-up. The ground connection is not removed from the receiver.

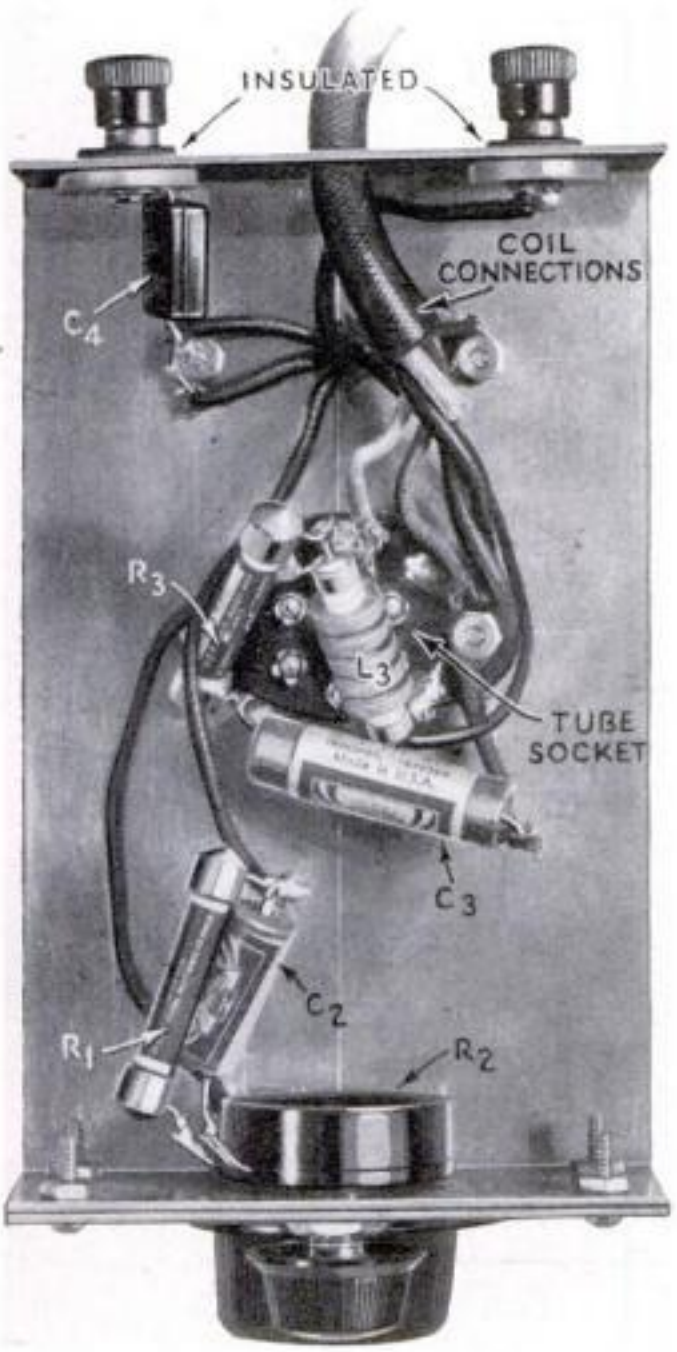
As mentioned earlier, it is advisable to make an initial test of the preselector before making the coil alterations. This will simplify the tracing of difficulties, because it eliminates a possible additional point of trouble. When operating properly under test conditions, the tuning will be broad and image suppression may be incomplete, particularly at the higher frequencies. The regeneration control should be entirely advanced to place a minimum of resistance in the circuit. After it has been found that the preselector is working properly on all bands, the coils should be tapped.

Although the main object of using a preselector with a superheterodyne is to reduce image response, a substantial increase in amplification also results. This manifests itself by a decline in the prevailing noise level. Also, when used with a simple regenerative receiver, an appreciable improvement in the sensitivity will result.

In order to obtain maximum amplification, it sometimes will be possible to move the coil taps closer to the end of the coil and still produce oscillation. Experiment with the location of taps, keeping the position where oscillation just occurs when the regeneration control is almost entirely advanced to give minimum resistance.

USING BOTH HANDS TO SELECT STATION

Preselector in use with a regenerative receiver. It can, however, be used with a superheterodyne as well. Note, under operator's left hand, the additional coils

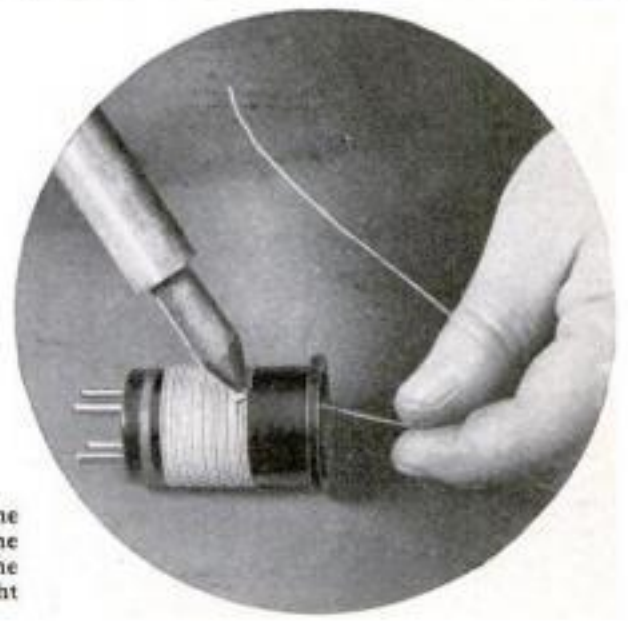


Bottom view, showing choke, condensers and wiring

List of Parts

L_1 and L_2.—Plug-In coils, set of four.
L_3.—Radio-Frequency choke, 2.3 mh.
C_1.—Variable condenser, midget, 140 mmf.
C_2 and C_3.—Fixed condensers, paper or mica, .01 mfd.
C_4.—Fixed condenser, mica, .0005 mfd.
R_1.—Resistor, metallized, 250 ohm.
R_2.—Volume control, 10,000 ohm.
R_3.—Resistor, metallized, 100,000 ohm.

Miscellaneous: One five-prong isolantite coil socket, one six-prong wafer socket, two binding posts, dial, knob, panel, chassis, one type '58 tube, solder, wire, etc.

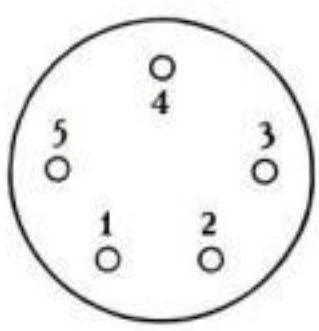


FOR REGENERATION alter the five-prong coils by tapping each one near the top end as indicated in the photograph reproduced at the right

HOW TO WIND THE COILS

RANGE (Meters)	L_1	L_2	TAP AT
12-24	4¼ T. No. 26 DSC	*4½ T. No. 22 bare	1½ T.
24-48	6¾ T. No. 26 DSC	*10½ T. No. 22 bare	2 T.
48-96	7¾ T. No. 26 DSC	*22½ T. No. 24 DSC	2 T.
96-200	15¾ T. No. 26 DSC	**50½ T. No. 26 DSC	3 T.

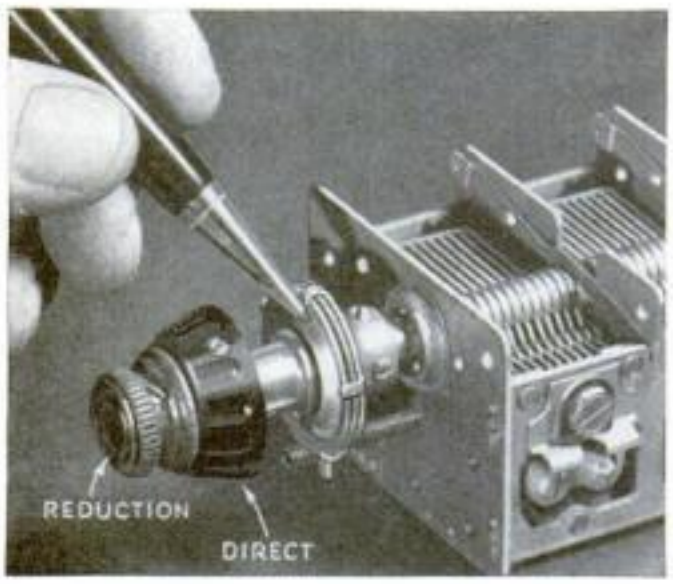
*—Turns spaced to occupy one inch
**—Turns spaced to occupy one and one half inches
All coils wound on one-and one-quarter-inch diameter, five-prong forms.



BOTTOM OF COIL SOCKET

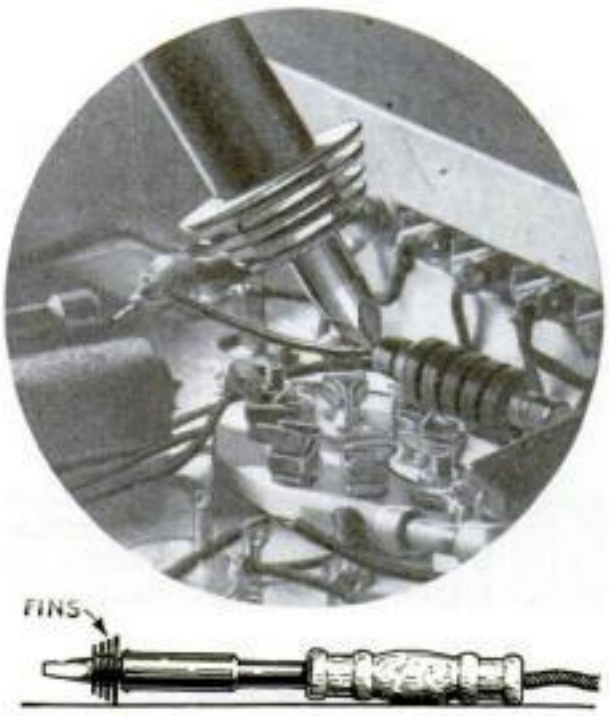
NEW TOOLS AND METHODS FOR

The Radio Handy Man



Metal Fins Improve Soldering Iron

RADIATING fins like those used on motor-cycle cylinders are now available for soldering irons. The fins, sold as a unit, are simply slipped over the end of the iron at the tip. Once in place, according to their designer, they reduce oxidation and corrosion, help to maintain a more constant heat, prevent overheating, and provide a convenient rest for the tip of the iron when it is not in use, as shown in the drawing reproduced below.



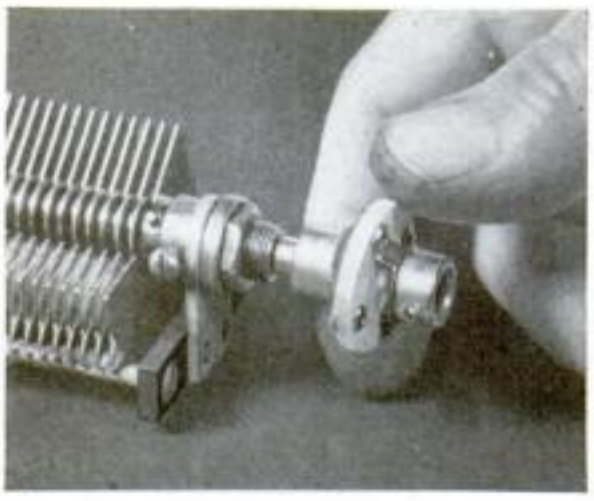
Soldering iron with radiating fins which reduce corrosion and help in other ways

Finishing Aluminum

AMATEURS who have attempted to brush-finish aluminum panels with a wad of ordinary steel wool know that it can be a long and sometimes painful process. An inexpensive rubber-handled kitchen scouring pad is ideal for the purpose. It can be rubbed over the surface in straight strokes to provide a dull finish, or it may be used as shown in the illustration, to give an artistic milled effect. To mount the pad in a hand drill, drive a short length of dowel rod into the center hole, supplied in the top of the handle, glue it in place, and then clamp the dowel in the jaws of the chuck.—E. B. LYFORD.

Condenser Gear Box Has Double Control

A SIMPLE gear box now available can be used to provide a five-to-one reduction drive for any variable condenser. Equipped with a convenient double control as shown, the dial allows for either a direct or a reduced drive depending on whether a coarse or fine adjustment is needed. The unit, constructed along the lines of friction planetary gearing systems, operates with a minimum of back lash and allows accurate vernier tuning. Incidentally, because of their small size, two or more of these drives can be connected in series, two giving a reduction of twenty-five to one; three will provide a one-hundred- and twenty-five-to-one ratio and so on, to provide the degree of accuracy desired.

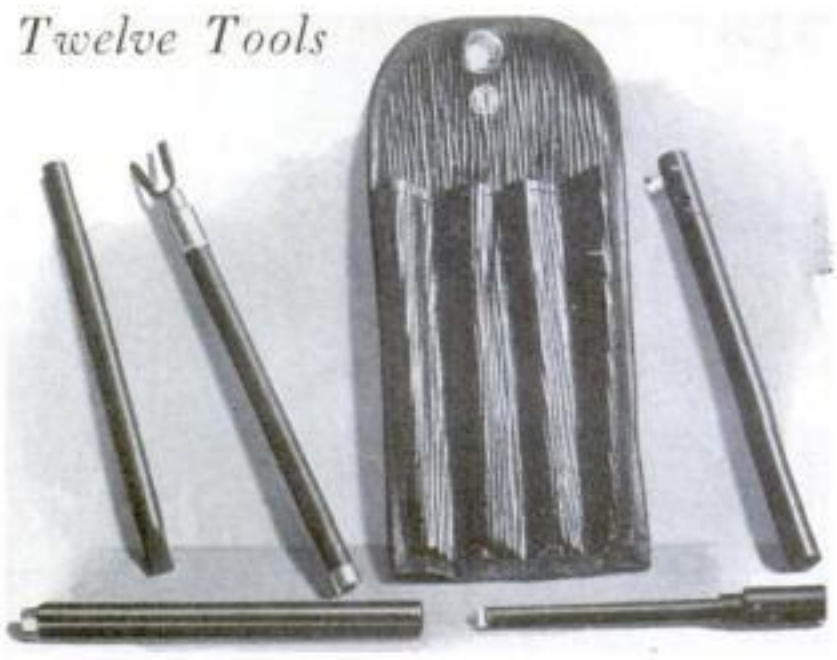


Condenser-Shaft Coupling

NO LONGER is it necessary to align variable condensers and dials accurately. The flexible couplings illustrated, which are miniature universal joints, even allow variable condensers to be ganged when their shafts are not exactly in line. Constructed around a ring of insulating material, they also allow ganged condensers to be used independently. Set screws in the collar at each end of the coupling make assembly easy in whatever arrangement is required.

Pocket Kit Holds Twelve Tools

TWELVE separate tools make up the latest pocket kit for set builders and servicemen. It provides every tool needed in aligning, neutralizing, and adjusting any type of receiver. Telescoping into one another to form four compact units to be stored in a flat case, the tools include four insulated screw drivers, one all-metal screw driver, three insulated socket wrenches, two metal socket wrenches, and two side wrenches.



Copper Screen as Shielding

ALTHOUGH aluminum is the most common metal for shielding purposes, it is by no means the only material that can be used. Ordinary fine-mesh copper screening, of the type sold by your neighborhood hardware store, is not only effective but easily worked. It can be cut with ordinary shears, rolled or bent into any shape, is easily soldered, and its open construction provides a means of ventilation not possible with shielding of the solid type. Because it can be tacked in place easily, it makes, in addition, an excellent material for lining cabinets made of wood.

Question: Why do most farmers paint their barns red? G. K., Louisville, Ky.

Here's *the* Answer

A.—FOR TWO psychological reasons and one reason of pure practicality. Red is a favorite color. Farmers have, by choice, painted their barns red for many centuries. The origin of the custom is to be found in folklore. Farmers are inclined to follow well-established conventions. Red barn paint, for a long period after its application, wears almost imperceptibly. It is made of Spanish red oxide, magnesia silicate and linseed oil. It is durable.

When a Whale 'Sounds'

R. E. L. S., NEW BEDFORD, MASS. Records of old whaling ships show that whales frequently dived so deep that as many as 600 fathoms of rope were uncoiled during the plunge that followed sinking of the harpoon. Six hundred fathoms are 3,600 feet, or approximately three fifths of a mile.

Care of a Tennis Court

D. E. H., WELLSTON, OHIO. To rid your tennis court of persistent sprouts of grass, use chlorated lime plentifully. Douse the protruding grass with the lime. Use about two pounds for each square yard of court needing attention. Roll your court often.

The Problematic Dirigible

Q.—WHEN A dirigible airship is moored at her mast, why does not her after end stick up into the air?—J. C. O'C., Ketchikan, Alaska.

A.—THE VESSEL is so constructed that, when she is properly trimmed for mooring, the lifting power of the confined gas is constant throughout her length.

Coloring Flies for Anglers

B. S., NEILLSVILLE, WIS. To dye fur and feathers for artificial lures for fishing, first wash the materials with curd soap, then remove the soap, and dry them. In a dark room, dissolve twenty ounces of gelatine in water, add three ounces of bichromate of potash, and then add whatever black dye you have been using. Dye the materials, then subject them to light. They will be waterproof.

Nobel Ambitions

Q.—HOW DOES one compete for the Nobel Prize in Physics?—W. B. T., Jr., Lorton, Va.

A.—THIS FAMOUS award is conferred upon a scientist who has made an important discovery or invention. The Swedish Academy of Science picks the man. One "competes" for this prize by dedicating years to study and to experiment in one chosen field. Recognition comes first through the publication of learned papers by scientific societies. Advanced university training may be desirable, but it is not a necessity. The best of luck!

Cures Distemper in Foxes

Q.—RECENTLY you published an article which described immunization of dogs from distemper. Can the process of immunization described be used on foxes? It would be a great help to breeders of foxes.—S. E. B., Gardena, Calif.

A.—YES, UNDER the direction of a qualified veterinarian. The living virus and the serum should be administered simultaneously, in the first treatment. The serum alone is injected into the fox again, ten days later, to complete the course of immunization.

A Good Timepiece

Q.—I HAVE a fine old watch my father gave me. I am checking up on its accuracy as a timekeeper. How near perfect should I expect it to be?—F. G. S., Elizabeth, N. J.

A.—RAILROAD men say that a watch should not vary more than thirty seconds a week, and keep their own watches checked accordingly. Every good watch needs adjustment from time to time. Temperature and climatic changes will always alter the time-keeping qualities of even the best of watches.

Easter Egg Rolling

B. H. M., LOS ANGELES, CALIF. The custom of rolling eggs on the White House lawn on Easter Monday is of obscure origin. In 1878, when petty officialdom forbade the children to use the Capitol terrace, the wife of President Hayes invited them to be her guests. The custom of egg-rolling comes from the Old World. Children of one of the embassy families perhaps introduced it in Washington.

Pearls from Fossil Shells

R. T., WILMORE, KANS. A specialist on gems informs us that pearls taken from fossil mussels and oysters usually are not valuable. Pearls found in ancient Egyptian tombs, and in Indian burial mounds, are not lustrous.

An American Motorist Abroad

Q.—IS AN automobile operator's license issued in the United States, good in Europe?—T. F. M., Cambridge, Mass.

A.—NOT ALL, but most European nations issue an International Traveling Pass to be displayed for inspecting officials. It makes possible the use of both operator's license and registration plates issued in the United States, for twelve months of driving about Europe.

Profit Made on Stamps

Q.—IS MAKING a profit on the sale of postage stamps a violation of Federal law?—F. J. C., Chicago, Ill.

A.—POSTMASTERS and postal service employees are forbidden to sell postage stamps for more or for less than the face value. But this law does not apply to private persons or firms.

Comets By Day

Q.—HAS ANYONE ever seen a comet in the daytime, with the naked eye?—J. M., Boston, Mass.

A.—DOUBTLESS, in the long passage of the centuries, many persons have. Recently,—that is, in the nineteenth century—one was seen in September, 1882, and another in February, 1843.

Earth's Most Abundant Metal

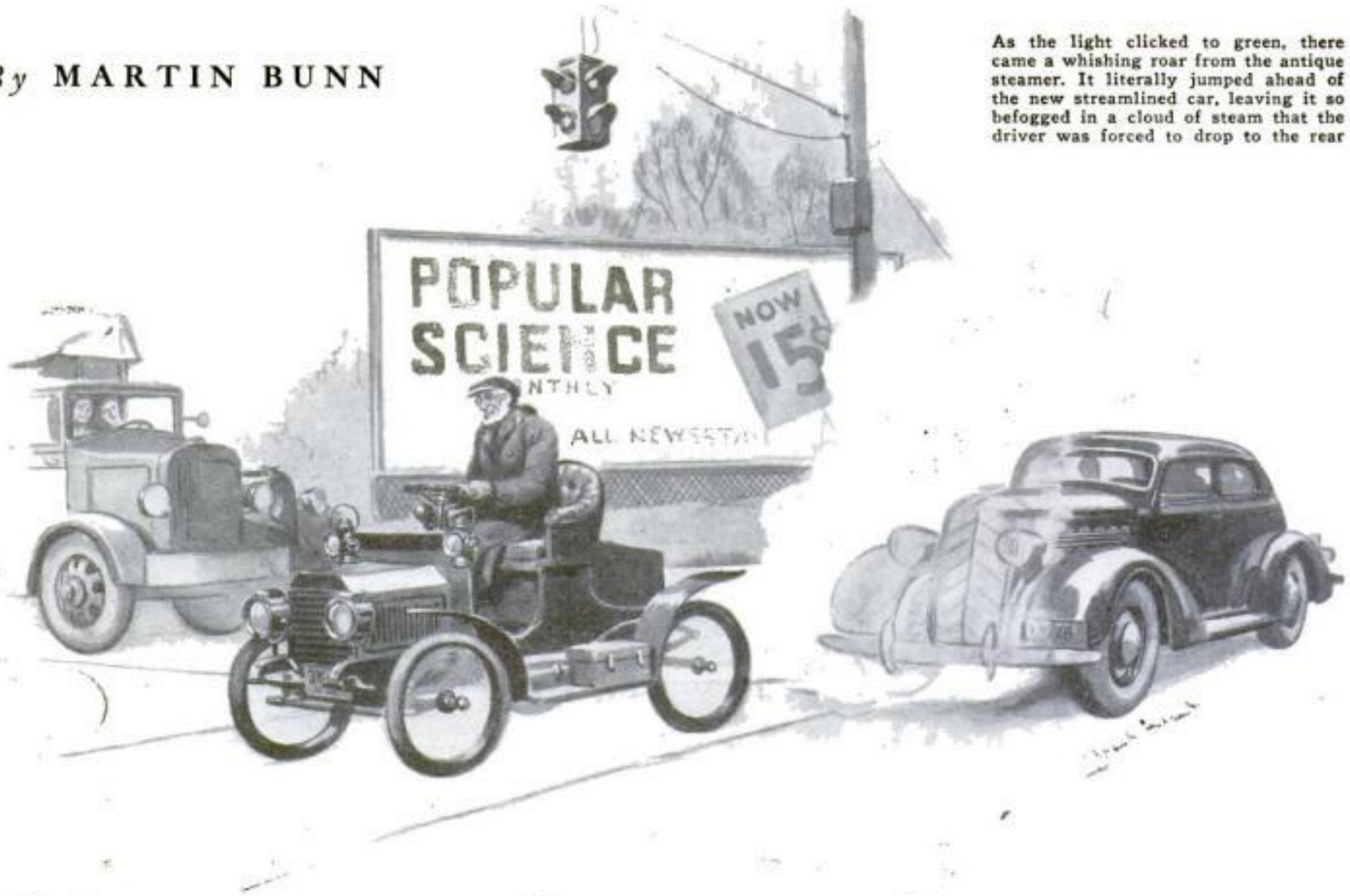
W. H. L., CHEYENNE, WYO. Aluminum is the most abundant of all metals in the crust of the earth, scientists now believe. Despite its great abundance, aluminum was not discovered as a distinct and individual metal until 1824.

Then Eat the Apple

Q.—IS THERE any way to grow one's initials, monogram, or trademark on an apple?—D. W. B., Timperley, England.

A.—AFTER BLOSSOM time, when the apples are small, apply the design you have chosen, cut from adhesive tape or metal foil, to the side of the apple that will ripen earliest. Do not remove tape *(Continued on page 111)*

By **MARTIN BUNN**



As the light clicked to green, there came a whishing roar from the antique steamer. It literally jumped ahead of the new streamlined car, leaving it so befogged in a cloud of steam that the driver was forced to drop to the rear

Hints on Quick Get-away

GUS WILSON and Joe Clark, his partner in the operation of the Model Garage, were enjoying the first warm spell of spring during a lull in Saturday-afternoon activities.

From where they were sitting in front of the garage, they could see the intersection of two state highways, which presented a scene of more than usual activity. Suddenly, Joe straightened up and stared at the cross roads.

"Say, for the love of Mike!" he exclaimed, "Where'd old Noah and the ark come from?"

Gus looked up and a smile broke over his grizzled features as he took in the amazing vehicle waiting for the green light. Spidery wire wheels, and a hood that looked like a cheese box, were the most striking features of an ancient roadster occupied by a shriveled-up little man. Trim gray whiskers edged his chin and old-fashioned gold spectacles framed his eyes.

As if to accentuate the general effect, a streamlined car of the very latest vintage slid to a silent stop beside the oldster.

"Don't you know who that is?" grinned Gus. "Well, now, you just keep your eyes peeled and see what happens!"

The streamlined car had crept ahead several feet and was in motion as the light clicked to green. At that instant, there came a whishing roar from the old vehicle and it literally jumped ahead of the new car, leaving it so befogged in a cloud of steam that the driver was forced to slow up and drop back.

The antique steamer whizzed up the road past the Model Garage, and the driver of the other car pulled up and stopped by the gas pump.

"What in blazes was that, Gus?" he called, as he stared angrily at the spidery car shooting up the steep grade with a comet-like trail of steam vapor trailing out behind.

"Gave you a bit of a start, did he, Mr. Williams?" smiled Gus. "That's old Angus Macduff, one of the best steam engineers that ever came out of Scotland. They say he's got that contraption of his so it will stand 1,200 pounds pressure. Some day something will let go and there'll be no more Angus!"

"Humph!" grunted Williams. "Trying to show my tail light to a load of liquid dynamite, was I? And yesterday, another fellow with a car exactly like mine put it all over me on the get-away."

"Maybe the car needs tuning up, but mostly a slow get-away in any modern car is just a matter of poor timing," Gus suggested. "Take old Angus and his steam car, for instance. He doesn't have to know anything about gear-shift timing. All he does is brace himself and give her the gun. There's no gears to shift. A steam throttle does it all."

"A gasoline car is something else again," Gus continued. "The engine has no power at all when it's idling and the power it can pass along to the back wheels to get you going depends on how fast the motor is turning over."

"According to that, you ought to have the motor racing before you let in the clutch if you want to make a quick get-away," Williams interrupted.

"Theoretically, yes," Gus replied. "Trouble is, if you do, you'll either tear the stuffings out of the clutch in no time at all or else you'll snap a shaft or strip a gear. You've got to compromise, and the proper stunt is to have the motor turning over pretty well but not so fast you'll bust something or tear hunks off the tire treads. The best idea is to try starting from a standstill with the motor turning at different speeds till you find the one that gets the car in motion in snappy style."

"I never thought of making any tests like that," Williams commented.

"TRY 'em—you'll learn something. The next step is to find at what car speed it's best to shift to second speed. Lots of drivers make the mistake of staying in first too long. First speed in any car always is geared so low that it's a power instead of a speed gear."

"When should you shift to second?" asked Williams.

"That depends a lot on the car, and particularly on the weight of the motor flywheel and crankshaft. You see, when you shift from first to second, there's a whale of a change in motor speed because of the big difference in the gear ratio between the two speeds. And the faster you're going when you make the shift, the more difference there'll be in revolutions per minute.

(Continued on page 79)

WILLIAM JACKSON tells how to build a new

High-Speed Boat

FOR SMALL OUTBOARD MOTORS

It planes at twenty miles an hour with only a four-horsepower engine and makes thirty-five with one delivering ten horsepower

HERE is *Petite*, a fine, fast little craft, 7 ft. 11 in. long, for use with a small outboard motor of from 4 to 14 H.P. It can be easily built in a few days from about $14 worth of materials, yet will furnish sport and pleasure for many seasons.

A motor of the fisherman's variety, developing only 4 H.P. and designed to propel a rowboat, will make *Petite* plane at 20 M.P.H. with one person aboard. A 10-H.P. motor raises her speed to 35 M.P.H. and better.

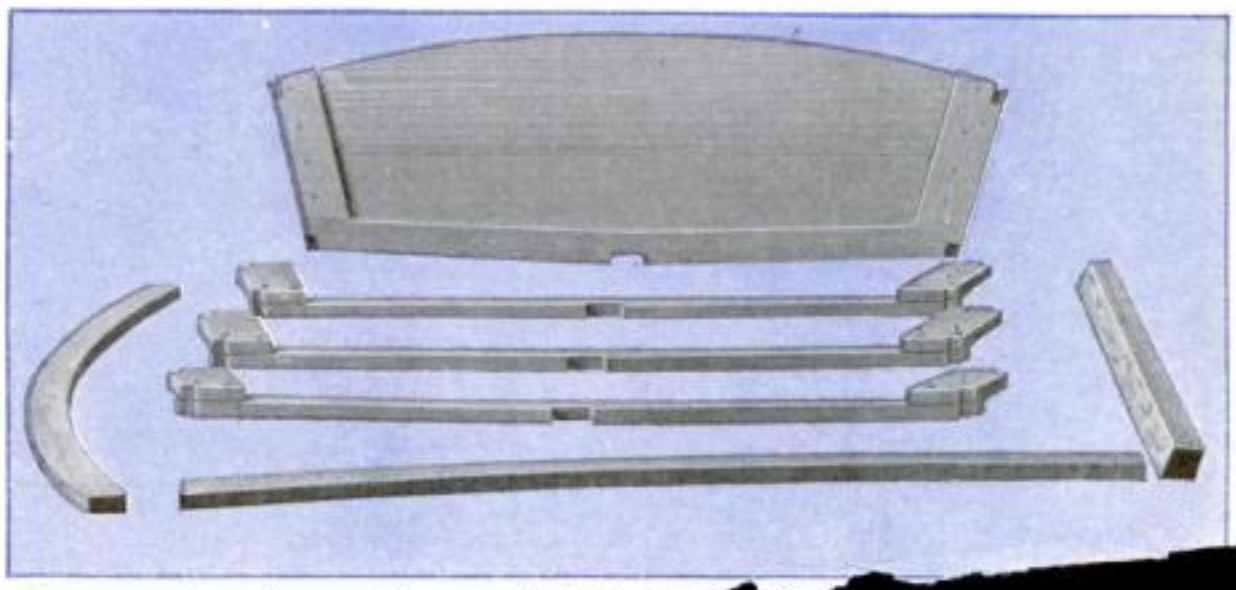
The boat is of the scow type—simple, strong, and speedy. The lap-strake construction not only contributes to the speed and strength, but it is also easier than using batten seams. All parts are cut from standard widths and lengths of lumber. The cost should not exceed $12 or $14, depending upon the materials and the locality where they are purchased.

Even at full speed *Petite* can stand quite a welter of water. She has proved safe and seaworthy out of all proportion to her size. Weighing only 75 lb., the boat may be transported anywhere atop an auto or by trailer. Although designed for knockabout use with small motors, *Petite* can be used for fishing, hunting, or merely cruising about well-sheltered waters.

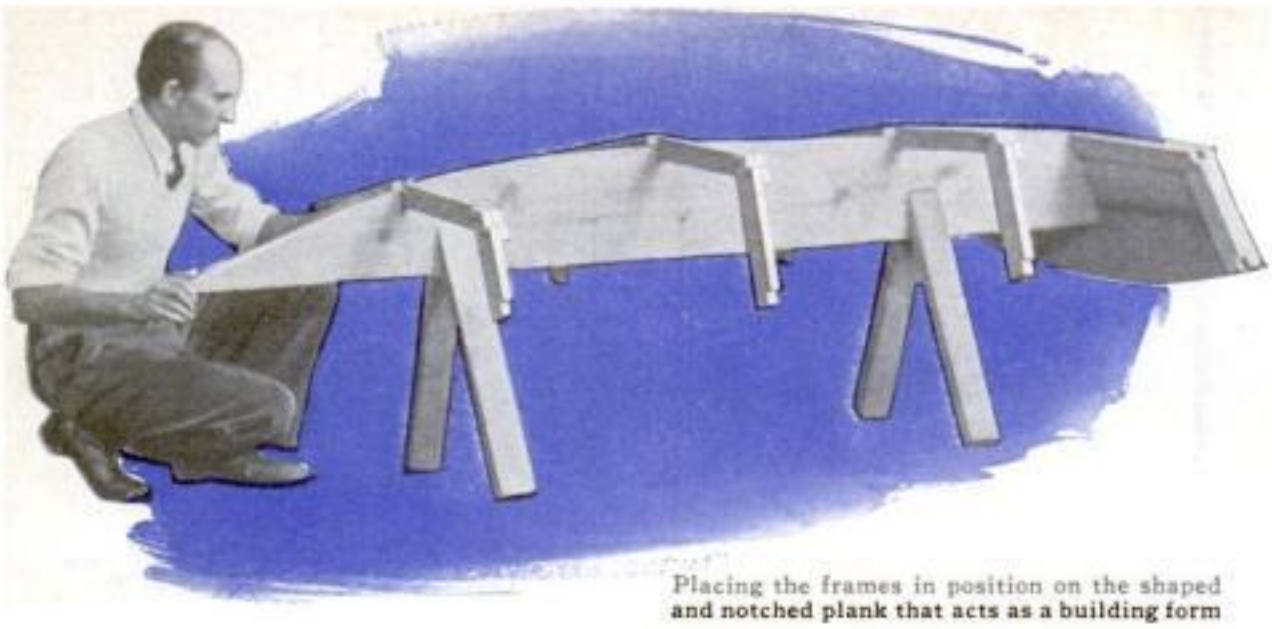
The first step in constructing the hull is to lay down the lines full-size on a large sheet of paper. Spread the paper on a smooth, clean floor, and with a chalk line or string, mark a perfectly straight line on the lower edge of the paper. This is the base line, and all measurements are started from this point. By first making a full-size drawing of the boat, the builder will be enabled to eliminate any possible errors and will get a clearer conception of the hull. When the layout has been made from the accompanying drawings, full-size paper patterns for the frames are drawn on heavy paper. The bevels of the frames and patterns for the stem may also be taken from the full-size drawing.

The form upon which the hull is to be built should be sawn out of a 2 by 12 in. by 8 ft. piece of yellow pine or any common lumber. Legs similar to a sawhorse are attached at a convenient height.

Lay the full-size patterns upon the frame material and prick the outline through. Saw the side and bottom members out and trim evenly. Assemble the members on the paper patterns so as to conform to the outlines and join the parts together with two 1¾ by ¼ in. carriage bolts to each joint. The transom frame is fastened to the transom with 1⅜-in. No. 8 flathead screws, spaced 4 in. apart. All screws, it should be noted, must be galvanized or brass and of the flathead variety. Lead holes should be drilled for all fastenings to avoid splitting the wood.



You can see from these parts how simple the boa[t] transom attached, and the keel are shown



Placing the frames in position on the shaped and notched plank that acts as a building form

The keel, chine, and inwale notches are marked on the frames and sawn out. At the transom these notches are sawn in the transom frame only and do not extend through the transom.

The frames are temporarily assembled on the form. A light batten is sprung around the frames, and the bevels are marked on the edges of the frames. The only frames requiring beveling are the bottom edge of the transom and the edges of frames Nos. 1 and 2. The frames are beveled so that the chines, keel, inwales, and planking will fit evenly.

The end of the ¾ by 2 in. keel is beveled to fit the transom notch and clamped or attached with screws to the form. These screws are removed before the boat is planked. Attach the keel to the frames with two 1¾-in. No. 9 screws at each joint, countersinking the heads so the keel may be beveled.

The stem is cut from a 1¾-in. piece—a "two by four" will do—and beveled correctly. Notch the stem out for the keel, place it at the end of the form, and fasten the stem to the keel with two 1⅜-in. No. 8 screws.

Attaching the ¾ by 1 in. chines and inwales is the next step. The ends of these are beveled to fit the transom notches and attached with one 2-in. No. 9 screw to each chine joint and one 1¾-in. No. 9 screw to each inwale joint. Attach first one side, then the other, to prevent pulling the frame out of shape. The ends of the chine are fitted to the side and flush with the lower beveled edge of the stem. The lower edge of the inwale is beveled so as to fit flush with the top edge of the stem, and fastened to the stem with one 2-in. No. 9 screw.

The entire frame is now trimmed and faired so the planking will lie evenly. A light batten laid over the frames will show any uneven joints or edges.

The frames are now securely braced from the floor. Measure carefully to prevent the frame from being twisted or otherwise out of alignment. The steering qualities and performance of the finished boat depend upon true, accurate lines. The attachment of the side planks will hold the lines of the hull.

The ⅜ by 12 in. by 8 ft. planks are now clamped to the sides, allowing 4½ in. to extend aft of the bottom edge of the transom. Mark along the chines and inwales, remove the planks, and saw to shape. Liberally coat the chines and transom with white lead or liquid marine glue, and clamp the planks in place. Attach the planking to the frames, chines, and inwales with 1-in. No. 8 screws spaced at intervals of 2½ in. Insert a double row of screws at the transom and stagger them to prevent splitting. With both sides fastened, trim the plank edges evenly at the chines so the bottom planking will lie evenly.

Mark a center line on the keel. This serves as a guide for the keel planking seam—the only seam on the bottom. Clamp a plank in place, its edge even with the keel center line, and extending 4½ in. aft of the transom. From frame No. 2 forward to the bow, the plank edge will overlap the keel center line. Using a batten, mark the plank edge so that it conforms with the keel center line. Saw and plane to shape and use one plank as a pattern for the other. Clamp the planks to the bottom, mark the frames along the outside edge, remove the planks, and make a saw cut ¼ in. deep at each mark. Cut the notches for the planking with a chisel or drawknife. Do not notch the stem.

Coat the transom notch and keel with white lead or glue, and reclamp the planks in place. Fasten with 1-in. No. 8 screws spaced 2½ in. apart.

The remainder of the plank notches are cut in like manner, allowing 1-in. for the plank lap between planks. Before attaching a plank, coat this lap with glue or white lead and lay strips of cloth upon it. When the planks are fastened together, the glue or lead and cloth insure a perfectly water-tight joint.

At the stem, bevel the planking back 1 ft. so both

List of Materials

SPRUCE, FIR, OR YELLOW PINE

Frame sides and bottom members	1 pc. ¾"x8"x12'
Transom	1 pc. ¾"x8"x8'
Chines	2 pc. ¾"x1"x8'
Keel	1 pc. ¾"x2"x8'
Inwales	2 pc. ¾"x1"x8'
Deck beams	1 pc. ¾"x10"x4'
Motor board	1 pc. ¾"x10"x15"
Center deck piece	1 pc. ¾"x1¼"x4'
Stem	1 pc. 1¾"x2¼"x39"
Outer stem	1 pc. 1"x1½"x41"
Moldings (half-round)	2 pc. ½"x1"x8'
Floor boards	6 pc. ½"x6"x4'
Carlines	2 pc. ¾"x1"x4'
Form	1 pc. 2"x12"x8'

MAHOGANY, CEDAR, CYPRESS, OR WHITE PINE

Side planking	2 pc. ⅜"x12"x8'
Bottom planking	6 pc. ¼"x8"x8'
Coaming	2 pc. ⅜"x2"x4'
Side decking	2 pc. ⅜"x6"x4'

HARD COMPOSITION BOARD

Decking	1 pc. 4'x4'x¼"

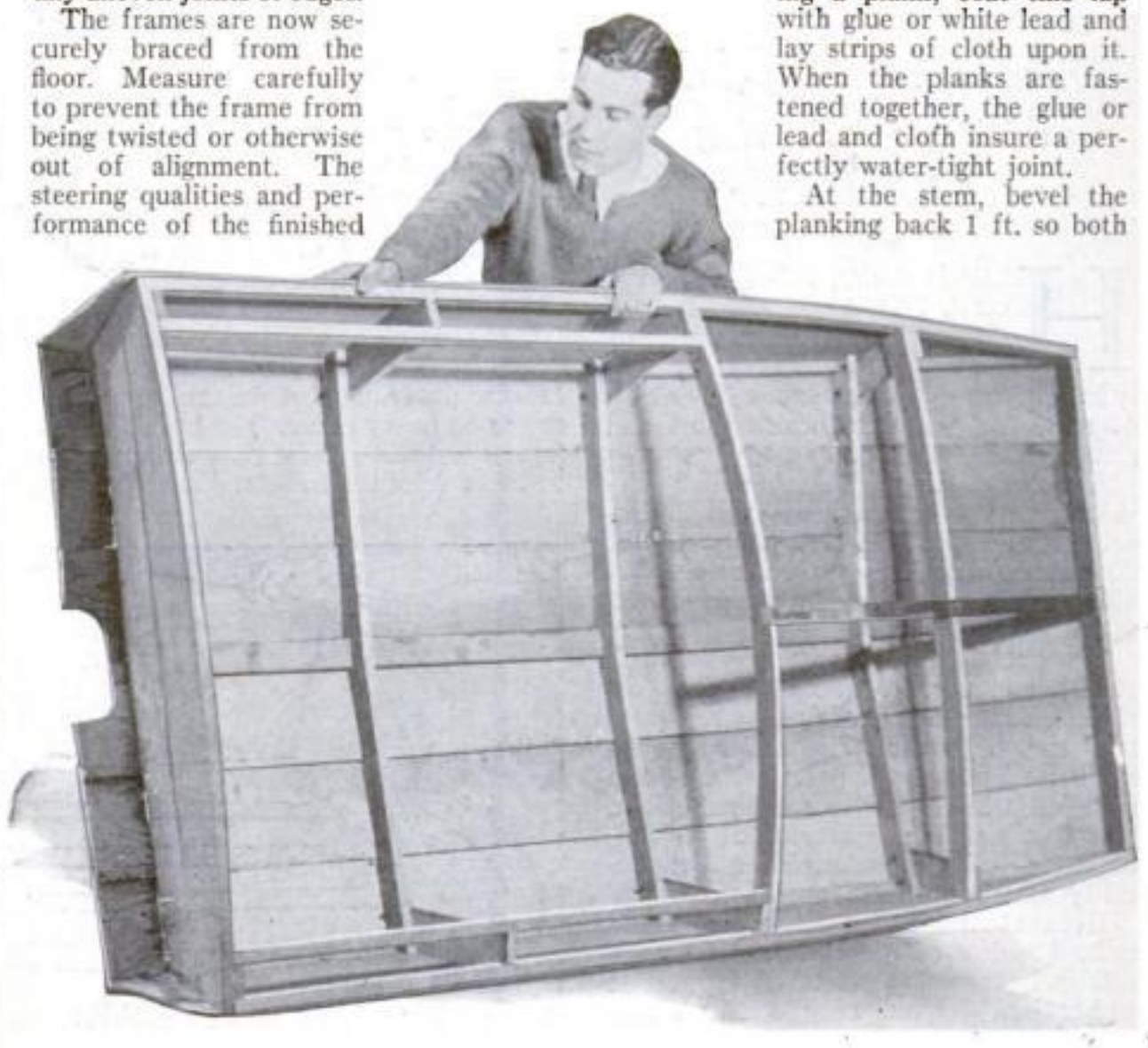
FASTENINGS

24—1¾" No. 9 F. H. screws
10—2" No. 9 F. H. screws
4 gross 1" No. 8 F. H. screws
½ gross 1⅜" No. 8 F. H. screws
12—1¾"x¼" carriage bolts
¼ lb. ¾" clout nails

NOTE: Use either galvanized or brass screws. Copper clout nails are essential if boat is for salt water, otherwise iron nails will do.

MISCELLANEOUS

1 lb. white lead or 1½ pt. liquid marine glue
[illegible] muslin or thin flann[illegible]



The hull after being planked but before the motor board has been fitted or the deck applied. [illegible] composition board is used over the deck beams, and wood for the narrow decking at sides

edges of the plank lap will come out flush at the stem. The remaining planks are attached in similar fashion. Fasten the plank laps together with ¾-in. copper or iron clout nails, spaced every 2 in. Drill lead holes for the nails, insert, and holding a flat iron underneath, clinch them.

Turn the hull right side up and attach the deck beams to the frames with two 1⅜-in. screws to each joint. The beam at frame No. 2 is attached to the forward side, while beam No. 1 is secured to the after side of the frame. Notch a ¾ by 1¼-in. piece into the deck beams, and fasten with two 1⅜-in. No. 8 screws at each beam. The piece is merely butted against the stem.

The motor board is fitted to the transom and fastened with 1¾-in. screws.

Fasten the ¾ by 1 in. carline in place with 1¾-in. No. 9 screws to No. 2 beam and to the topsides of Nos. 3 and 4 frames.

A 4 by 4 ft. piece of hard pressed wood composition board is now clamped to the deck and fastened with 1-in. No. 8 screws spaced every 4 in. Trim flush at beam No. 2 and along the sheer and stem.

Clamp the ⅜-in. side decking in place, and mark and saw to size. Fasten with 1-in. No. 8 screws. Fit and fasten the ⅜ by 2 in. coaming against the carline and side decking with 1-in. No. 8 screws.

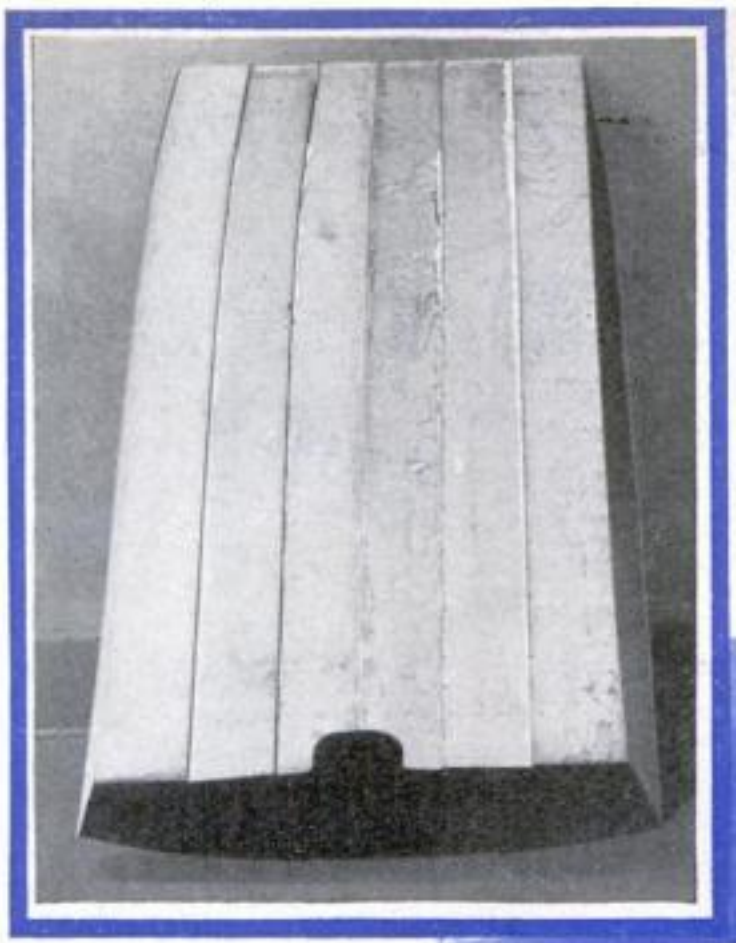
Trim the planking and composition board even at the stem, and fasten a 1-in. outer stem in place with 1¾-in. No. 9 screws. Round the edges off neatly.

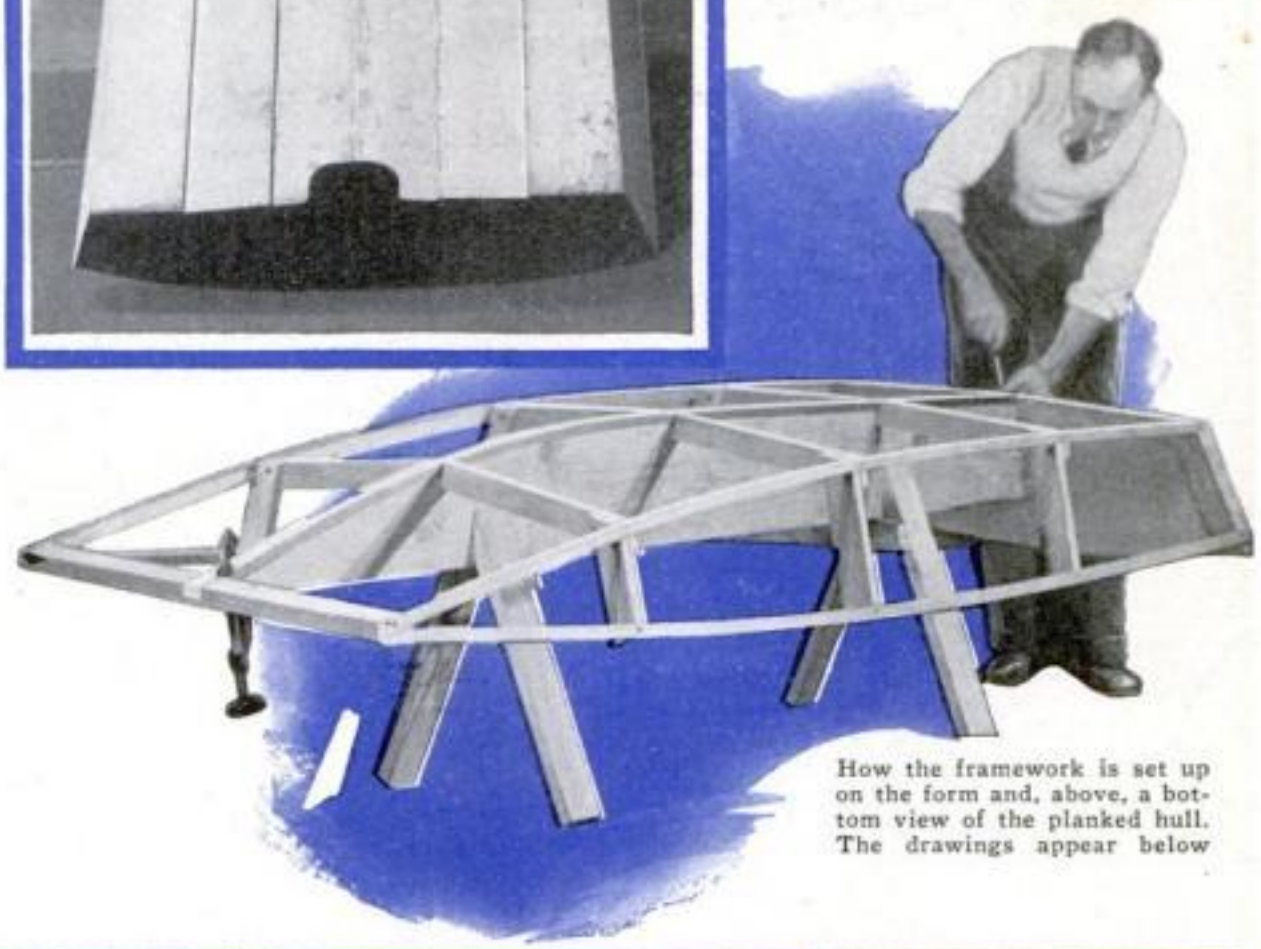
Screw the ½ by 1 in. half-round molding to the sheer with 1-in. No. 8 screws spaced 6 in. apart. The extended side planking at the transom is sawn to the shape shown, and an opening 7 in. wide and 3½ in. deep is sawn out of the bottom planking to admit the motor. Reënforcing pieces ¾ by 1 in. are fastened in the corners of the extended side and bottom planking with 1-in. No. 8 screws.

Sand and smooth the entire hull, and fill all screw holes with white lead or plastic wood composition. Paint or varnish the hull with three coats.

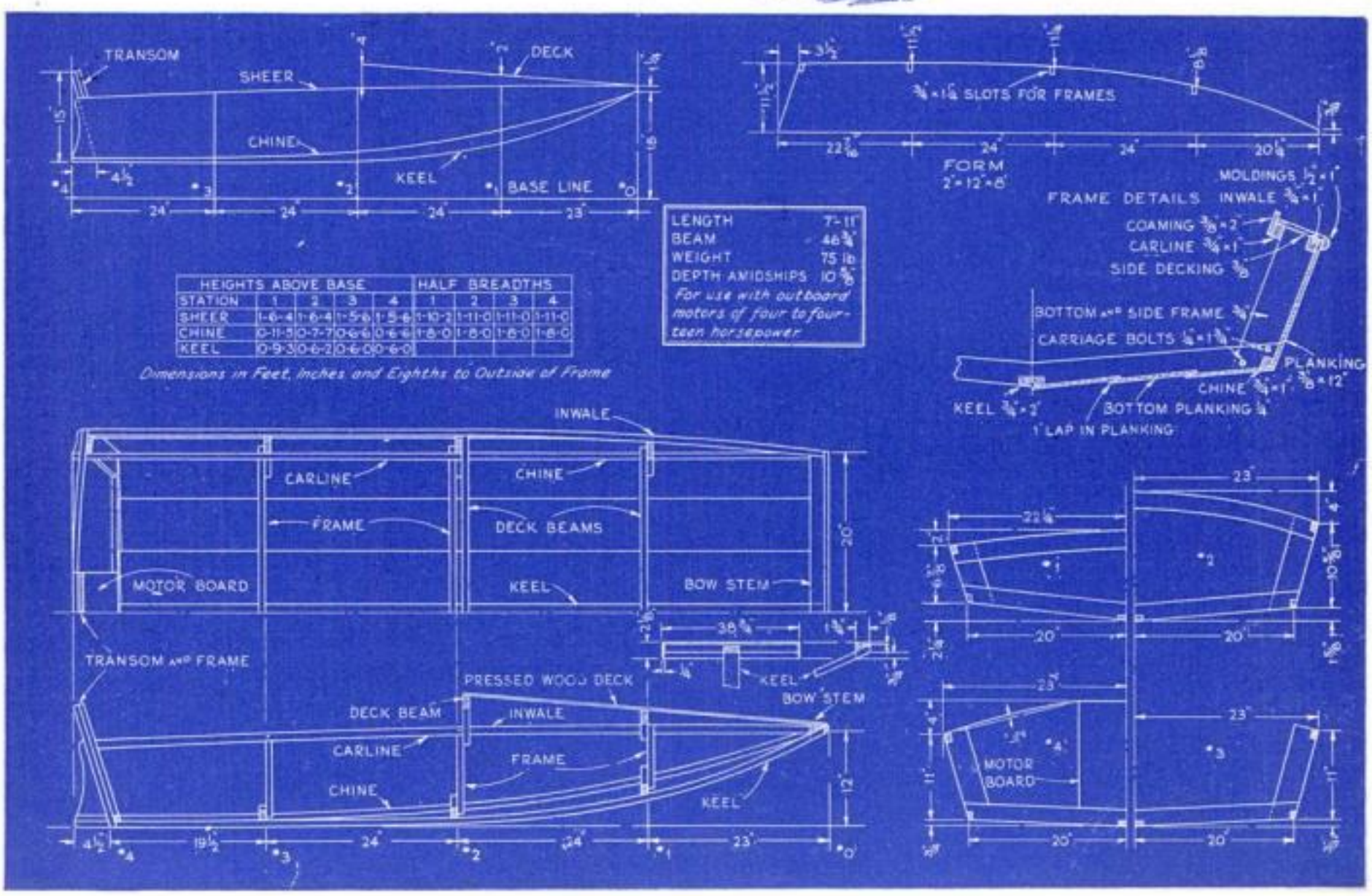
Fasten the floor boards in place with 1-in. No. 8 screws. Varnish or paint to match.

An eyebolt is attached to the stem. A small fin on the keel between frames Nos. 3 and 4 will assist in turning the hull.





How the framework is set up on the form and, above, a bottom view of the planked hull. The drawings appear below



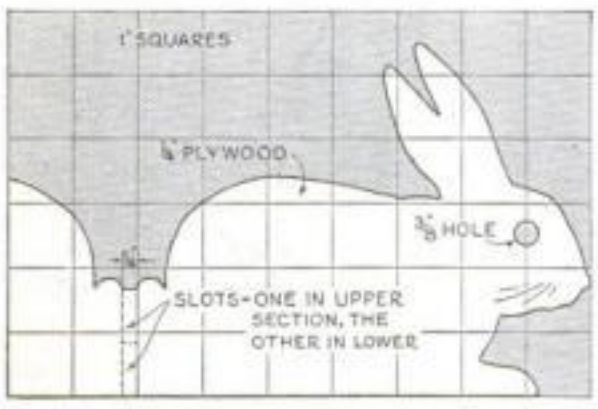
Jig-Sawed Bunnies Hold Easter Eggs

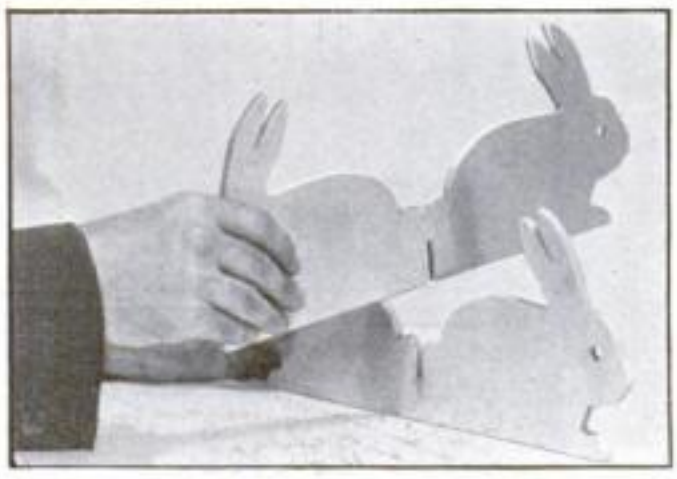
A colorful center decoration for the Easter breakfast table. Green tissue-paper grass is heaped around the holder for additional eggs

FOUR jig-sawed bunnies set up as shown make a novel stand to hold a plate filled with brightly colored Easter eggs. The whole forms an attractive center decoration for the table. Green tissue-paper grass may be placed in the angles between the rabbits, and a few eggs nested in the grass to add to the realism and Easter atmosphere of the setting.

The rabbits are cut from two pieces of ¼-in. plywood. First, prepare a full-size outline of one by sketching it on a piece of heavy paper on which 1-in. squares have been drawn. Cut this out as a template for outlining two bunnies on one piece of plywood. Then, if the two pieces of plywood are tacked together, both sections of the support may be sawed out at one time, with the exception of the slots at the center. It will be noticed that one slot is sawed in from the top, and the other from the bottom. Be sure that the slots are the right width to form a tight fit when the two pieces are engaged.

The eyes are indicated by boring ⅜-in. holes. Flat white paint will give a satisfactory effect, with whiskers painted on lightly, if you wish to add them.—GEORGE A. SMITH.





The two parts of the holder are cut as shown at left, then assembled as above with a half-lap joint

BOOK ENDS DEPICT CAT-AND-DOG FIGHT

Novel garden-gate book ends decorated with jig-sawed cat and dog engaging in argument

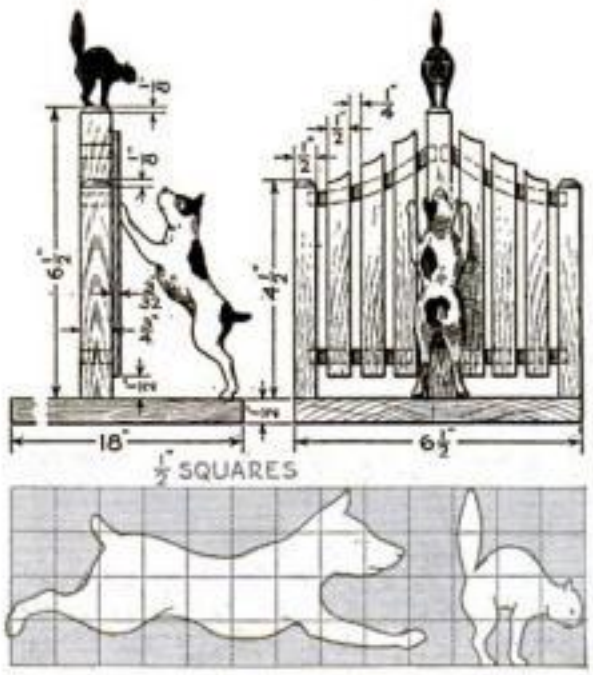
DO YOU remember the old gatepost that was always the favorite refuge for Blackie, the cat, whenever Towser came in sight? You can reproduce that old familiar scene in miniature form as a book rack for the den.

A hardwood such as walnut should be used for strength. The base is ½ by 6½ by 18 in., or any length to hold your favorite books. The other materials required are 4 pc. ¼ by ¾ by 3¼ in. for upper rails; 4 pc. ¼ by ¾ by 3 in. for lower rails; 2 pc. ½ by ¾ by 6½ in. for center posts; 4 pc. ½ by ¾ by 4½ in. for end posts; and 6 slats 3/32 by ¼, 2 being 4¼ in. long, 2 others 5 in., and the longest ones 5½ in.

Patterns for the dogs and cats are drawn and transferred to white pine blocks, and the profiles are sawed on a scroll or jig saw. The bodies are then partially finished by tilting them and sawing the curves of the back and sides and by cutting out the wood between the legs, between the ears, and removing the surplus from each side of the tail. The finishing is done on a spindle sander made of a ⅜-in. dowel rod covered with sandpaper and gripped in the drill-press chuck.

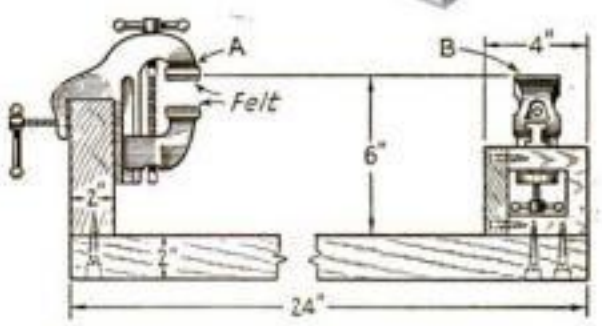
For painting the animals, an enamel will give a surface that is easy to clean. The gateposts are finished in dark brown, as is the center portion of the base. The ends of the base where they extend out beyond the fence may be enameled green to represent grass.

When the finish has dried, the cats are fastened by slender brads through holes drilled through the front shoulders. The dogs are merely cemented.—D. C. MARSHALL.



The assembled book end and patterns on ½-in. squares to aid in laying out the cat and dog

This tennis-racket vise is a help in restringing



INEXPENSIVE VISE FOR STRINGING RACKETS

A SERVICEABLE vise for restringing tennis rackets can be made as shown above from a few scrap pieces of 2 by 4-in. wood and two small inexpensive vises of the type sold in ten-cent stores. The base is 2 ft. long. The upper jaw *A* of one vise and the top *B* of the other vise should be 6 in. above the top of the base. The dimensions of the opening in the hollow upright therefore depend upon the size of the vise. Each upright is secured to the base by three 3-in. screws countersunk into the bottom of the base.

Felt should be glued to the inner surfaces of the jaws of both vises. The whole vise can be attached to any solid table or to a workbench by means of two C-clamps.—STANLEY VOLCHOK.

A Shelter FOR YOUR Weather Instruments

An easily built shelter for barometer, thermometers, and electrically coupled weather vane and anemometer dials

By Edwin M. Love

IF YOU have gathered together some instruments for your home weather bureau, you have already found that they are far from blood brothers in the matter of housing. The accommodating barometer can be in almost any location, inside or out, but that is not true of the thermometer. The temperature indoors is almost certain to be different from that outdoors.

The anemometer should be placed where it will receive the direct breeze, unaffected by eddies from buildings, and not becalmed in the lee of trees. The hygrometer, to represent average humidity conditions, certainly cannot hang in a damp cellar or over boggy ground. The sunshine recorder must be exposed to the sky throughout the day; and for visibility estimates, outside objects at known distances must be spotted to gauge the density of the fog. It all simmers down to a question of getting readings that represent the true conditions in your general locality.

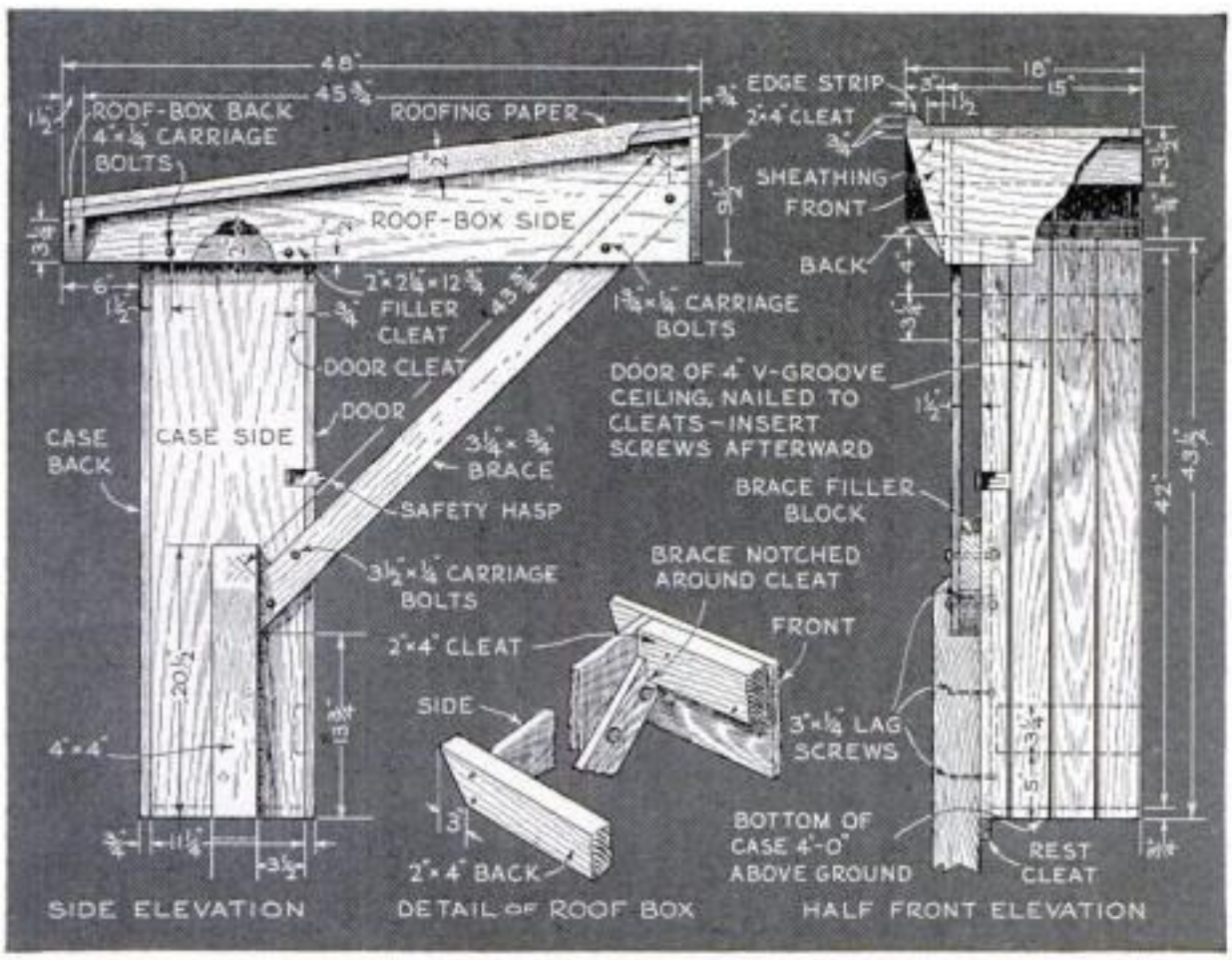
Probably the best solution is to group the main instruments in one outdoor case such as the one illustrated. It is inexpensive, simple to construct, and places the instruments where they can give reasonably useful readings. Set so tha the back of the case and the opened doo face the direction of the prevailing storms, it furnishes a dry and reasonably windproof shelter for the observer, without the need of putting up a building large enough to stand inside.

When purchasing lumber, select sound boards that have been surfaced on all sides, so that it will be easy to give a good weather-resistant coating of paint. Pine, fir, or other softwoods may be used. For the most part the dimensions are merely suggestive. The widths of the various pieces are those resulting from jointing the edges straight. In the lumber list, the commercial sizes are named, but the actual widths are less because of the reduction through surfacing.

Time will be saved if you shape all pieces before assembling. The ceiling boards for covering the back of the case and making the door may be rough-cut ½ in. longer than finished size, and afterward trimmed to fit the case. It is also just as well to give all parts an early priming coat. The ends, and the tongues and grooves of the ceiling, in particular should be coated with heavy paint.

The case is a plain box with butt joints. The toppiece extends over the upper ends of the sides, while the bottom fits between. If you have recording instruments too wide for the depth of the box, obtain wider side boards, or glue on strips with waterproof casein glue. By driving nails through edgewise, narrow strips can be glued on without the use of clamps.

Put the frame together with six 8-penny nails in each joint, driven at various angles to increase their holding power. There is no need of setting them for puttying. Square the frame and hold it with a strip of wood tacked diagonally across the front. Start to apply the ceiling material to the back by ripping the groove from a board, jointing it straight, and nailing it on. Blind-nail the other boards, and then nail up *(Continued on page 97)*

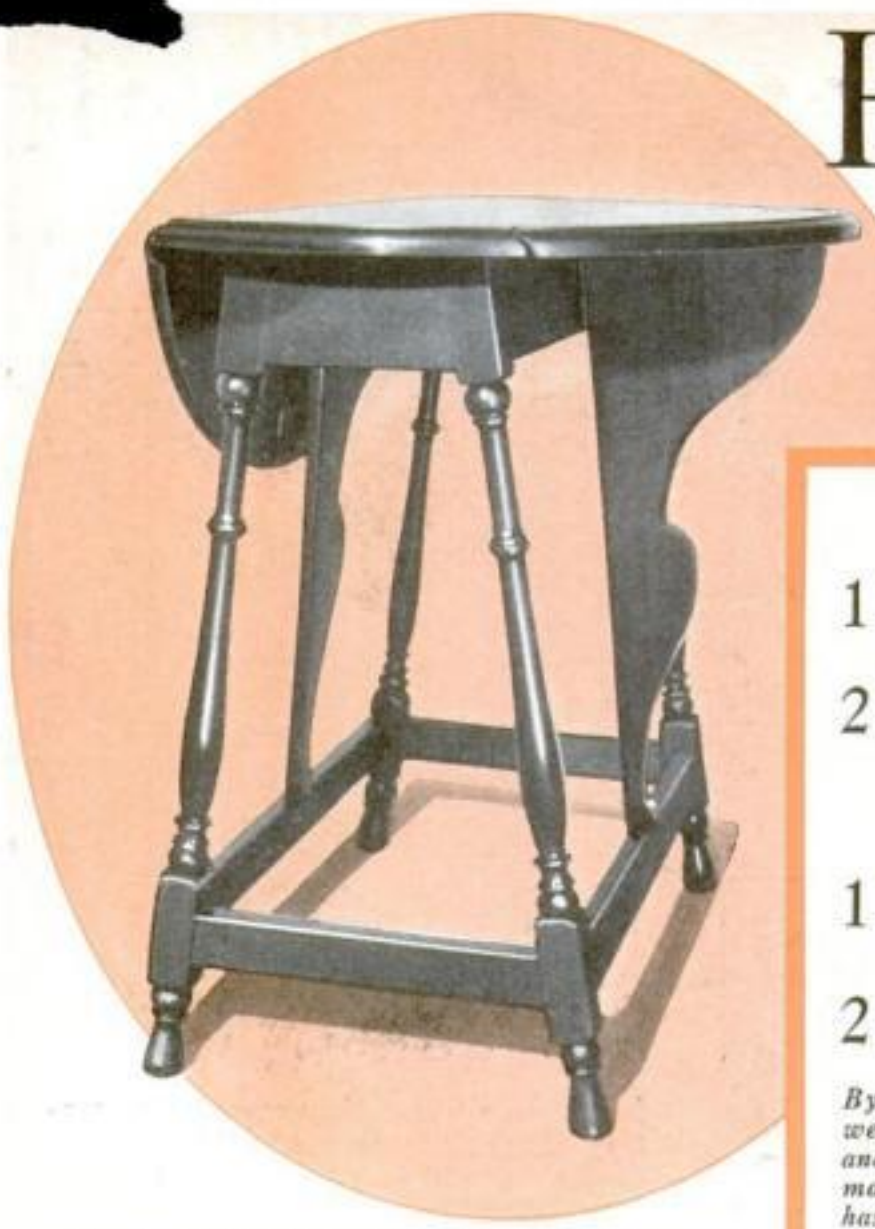


Side and front views and sketch of the roof construction. Holes are bored in the top and bottom of the case for circulation of air. The roof and opened door protect the user in bad weather

Here's *the* Table

A COLONIAL MAPLE PIECE SET OFF BY UNUSUALLY

By
Donald A. Price
Noted amateur craftsman and member of board of judges, National Homeworkshop Guild Handicraft Contest



You can't match this table in the average store. Note the fine proportions, the turnings, and the butterflies

Questions

1 What is the most popular piece of furniture an amateur woodworker can make?

2 What wood is just reaching the height of popularity?

Answers

1 Judging from the sales of our furniture construction kits and from the requests for plans received from readers, it is a butterfly table.

2 Colonial maple.

By putting both these answers together, we have a Colonial maple butterfly table, and the accompanying article tells how to make as graceful a piece of this kind as has ever been designed.

THIS useful little butterfly table, with its wings of graceful shape, bears the stamp of Early American design. For a correct period setting, it should be made of maple, the wood that is now reaching the full tide of renewed popularity. Walnut or mahogany, however, can be used with excellent effect.

Its small size and slender lines make the table suitable for association with almost any of the less formal types of furniture. No particular function is suggested because there is such a multitude of possible uses to which a small drop-leaf table may be put. No piece of furniture is more versatile.

There is nothing arduous about constructing this project as the parts are small and require an interesting variety of operations. Before beginning actual work, it is advisable to lay out the end view full size, not bothering, however, to work out the contour of the turnings unless it is desired to make a template for turning them. From this full-size layout it will be easy to determine the lengths of the aprons and the stretchers, as well as the exact angle to which they should be trimmed on the ends.

The leg stock should be cut 24 in. long and 1¼ in. square. Then lay out and cut the mortises. In making the original model, the mortises were routed out on the drill press as illustrated at the right after the turning had been finished, but by doing the mortising first, the danger of damaging the delicate turnings would be minimized. If a drill press is used in this operation, the mortises for the end pieces can be cut at the proper angle by tilting the drill-press table.

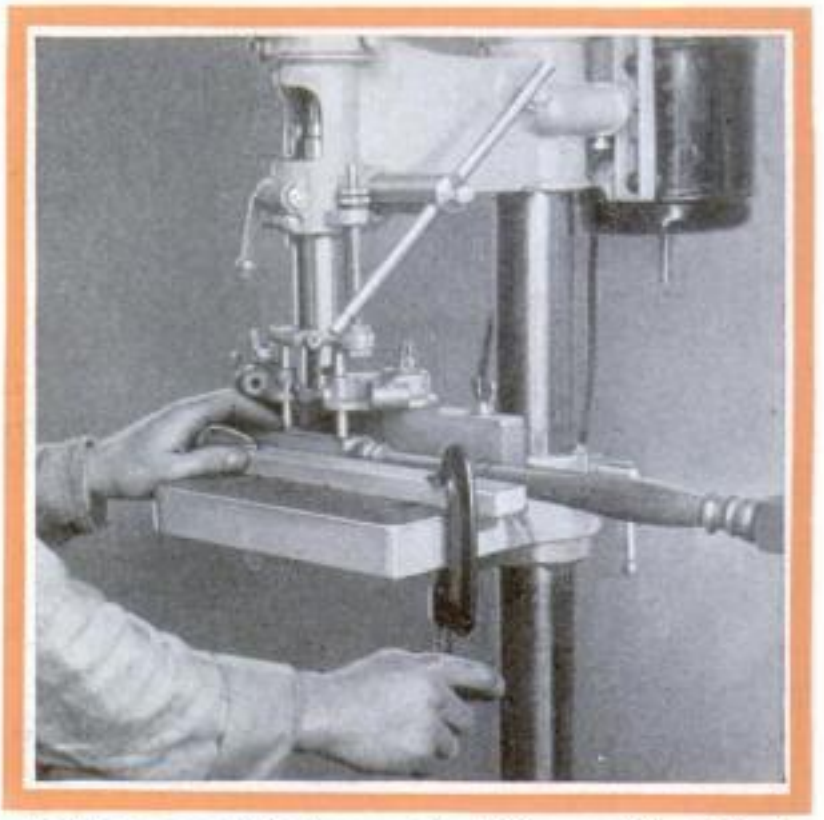
For the turning operation, be careful to locate the centers accurately. Use a steady rest to prevent any whipping and chattering of this long, slender piece, or run the lathe at a much slower speed than usual. The exact size of the end pieces should be taken rom the full-size layout. The side pieces are 16 in. long between shoulders. The stretcher is 13/16 by 1½ in. in section, and the apron 13/16 in. thick and 2 13/16 in. wide on the outer face.

After a trial assembly, glue up the ends of the frame separately. Level off the flush joint between the crosspieces and legs. Round the upper edge of the stretcher. Finish assembling the frame by gluing the side pieces in place. Test for squareness by measuring across the diagonals, placing a clamp, if necessary, across the longer one.

The wings may then be cut from ⅝-in. wood according to the layout on the drawings. A 5/16 by ½ in. strip of the same kind of wood is glued in a groove in the upper edge to strengthen it. Round off the back edge and drill for metal pivot pins, 3/16 in. diameter by 1 in. long. These may be made from a heavy steel wire nail of suitable size.

The solid top preferably should be glued up from boards about 4 in. wide. The center portion is 10 in. wide over all, and the drop leaves about 8 in. Finish all these to a uniform thickness. True up the abutting edges of the center portion and the drop leaves, and mold the section for the ruled edge joint. If molding cutters are available for cutting this curve, which must be a true radius, the job is simplified. If not, make templates of thin metal filed to the shapes shown in the drawings; then work the edges down till they fit the templates accurately. Most of the waste material may be cut out with the circular saw. A coarse round file and, finally, a round rod with sandpaper wrapped around it will be of assistance in finishing the concave section. The convex section on the center portion of the top can be brought to the proper contour with block plane and sandpaper.

Mortise the so-called "table" or "rule-joint" hinges flush with the underside of the top. Make sure, when locating them, that the center of the hinge pin is set exactly at the center of the radius of the joint as shown on the drawing. Sinking the hinges flush with the surface has the effect of raising the pivot point above the lower



Mortising one of the legs on the drill press. The table is tilted to cut mortises for the end pieces at the proper angle

Every One Wants *to* Build

OF DROP-LEAF DESIGN GRACEFUL BUTTERFLIES

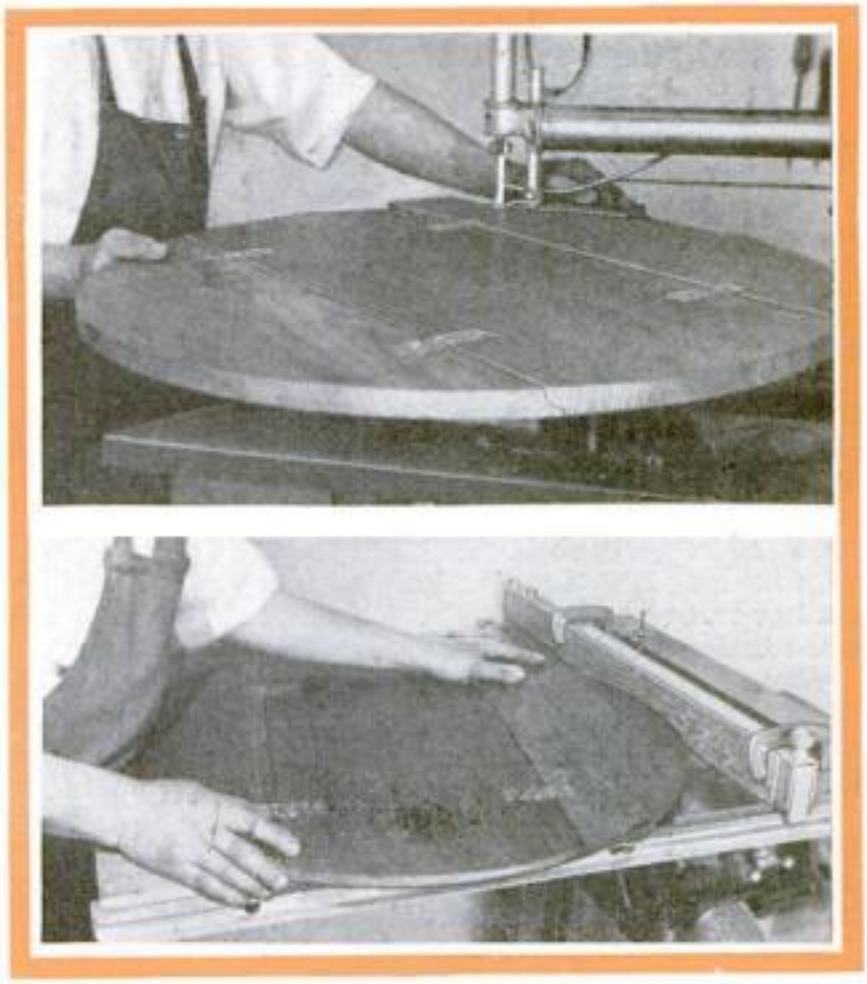
surface of the top, with the result that when the leaf is dropped, the hinges still remain concealed.

Now, with the three sections of the top still joined together, lay out the circumference and saw to the line as closely as possible. Finish to a smooth edge, free from any bumps or hollows. The molding may be done on the circular saw table with a molding cutter as shown in one of the photos. The top may be left assembled in doing this, but before molding across the rule joint, bevel back the corners, especially on the trailing edge, to prevent splintering them with the cutter. An alternative round edge is shown on the drawing that may be done with the block plane alone.

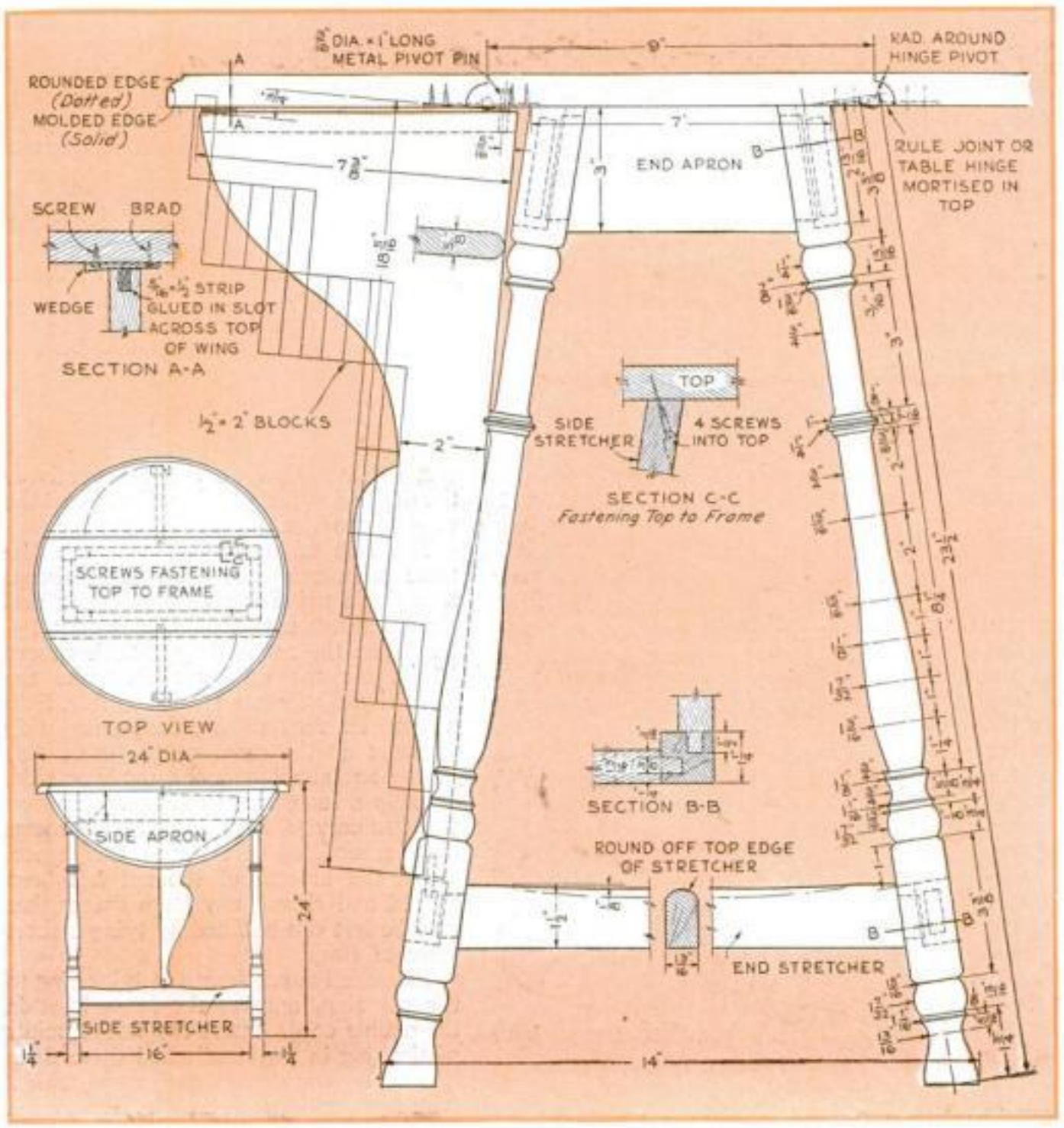
The pivot hole may then be bored in the center of the bottom side stretcher, and the top edges rounded off as shown.

Lay the assembled top face down on the bench and center the frame on it, fastening the two with four screws driven on a slant from the inside near each end of the side aprons, as shown in the section *C-C*. Locate the pivot point on the center line and about ¾ in. from the face of the side apron, being sure that the wing will swing without any interference. It will, of course, be necessary to remove the top in order to get the wings in place. Place a small steel washer under each wing.

Wedges are screwed and bradded on the underside of the drop leaves so that they bear on the wings at their outer extremities when open. The wedges may be made concave on the underside and of such thickness as to level the top properly when the wings are open.



Sawing the assembled top to the finished outline and, lower view, molding the edge on the circular saw table with a molding cutter



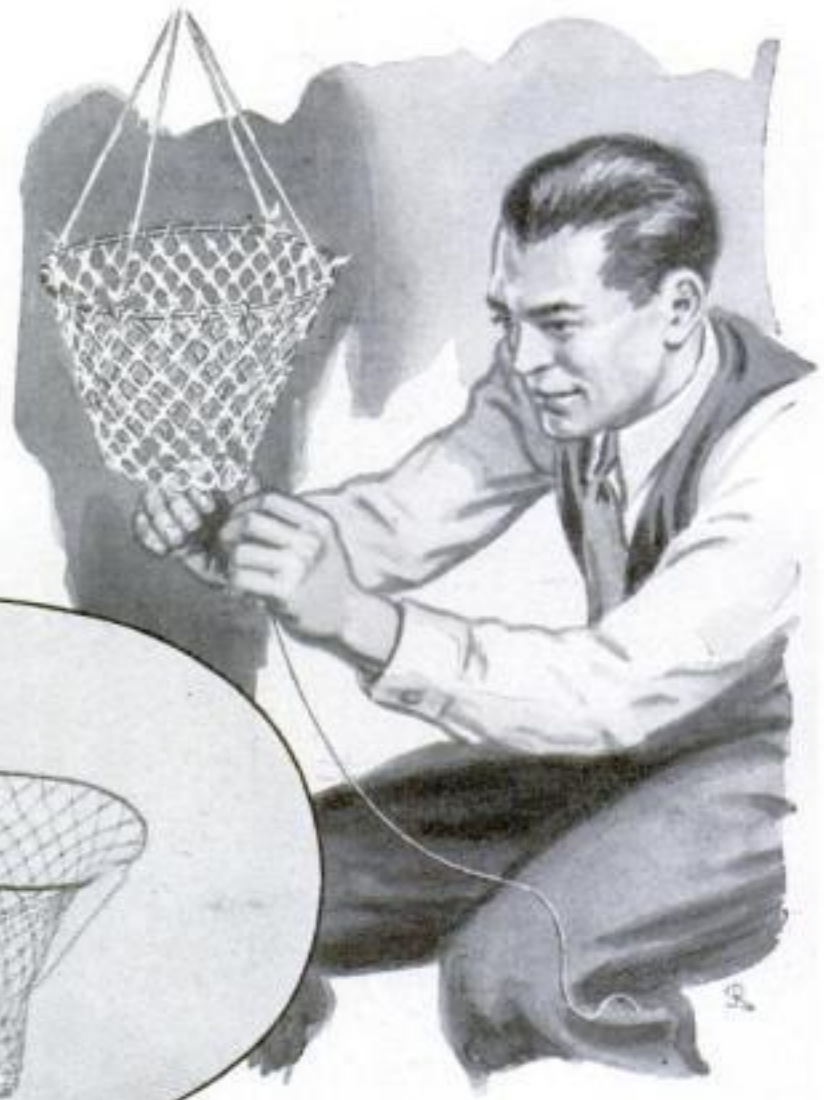
Take the table apart for finishing and remove all planer marks by scraping and sanding. Round off all sharp corners slightly. If an antique appearance is desired, carry out this rounding to a greater extent. Then give the bare wood a bath of water with a moist sponge or cloth. Let it dry thoroughly and sand off the raised grain. This treatment, besides reducing the amount of sanding required after the stain is applied, serves to bring out slight dents and grooves in the surface.

The desired color may be obtained by using water stains, in which case further rubbing down with No. 00 sandpaper or steel wool will be necessary. If an oil stain is used, no sanding will be necessary at this stage. If an open-grained wood, such as walnut or mahogany has been used, apply filler, stained to the proper color, rubbing it across the grain as the application becomes dulled through drying. Allow the filler to harden twenty-four hours or more, then varnish or lacquer the piece.

The model made by the author was finished with three coats of thin lacquer—that is, two parts of lacquer to one part of thinner. Each coat was rubbed dull with steel wool. Two coats of wax were finally applied to give it a dull luster.

LEONARD F. MERRILL, *Maine guide, gives fishermen*

Hints on Making a LANDING NET



A tying ring suspended by four cords is used to hold the net while being tied. When deep enough, the net is closed by shortening the loops and skipping a loop at intervals. The finished net is then transferred to the actual net ring, which is oval rather than round

ARE you an angler? Then why not spend a few hours in making a good landing net? The cord, if not to be found at hand, can be obtained from any large hardware, sporting goods, or department store. It may be cotton, hemp, or linen. Wading nets for trout are made of the smallest cord, and the minimum size for linen is No. 10. The larger landing nets, with handles 2, 3, or 4 ft. long, require cord or twine up to about No. 4, and for extra heavy nets, possibly No. 3.

A wading net will be described, but with slight changes as to size of net ring and depth of netting, you can make any kind of landing net needed.

Materials. A 3-ft. length of galvanized or rust-resisting iron wire, ⅛ or 5/32 in. in diameter; 1 pc. soft wood 1¼ by 1¼ by 6½ in.; a ⅝-in. brass ferrule or strip of brass for making one; 1 screw eye not less than ¼ in. inside; 1 ball No. 10 linen twine or cord; and whatever you prefer for carrying the net. Three methods of carrying are in common use: a quick release snap fastened to the ring of the creel harness; a stout piece of cord or light rope about 3 ft. long attached to the net and fastened to the coat, the net being thrown over the shoulder when not in use; and a loop of elastic attached to the handle. Either of the first two is preferable to the elastic.

Tools. The only special tool required is a ring of wire about 10 in. in diameter suspended from the ceiling by four cords. The ends are held together by slipping two tiny rings over them.

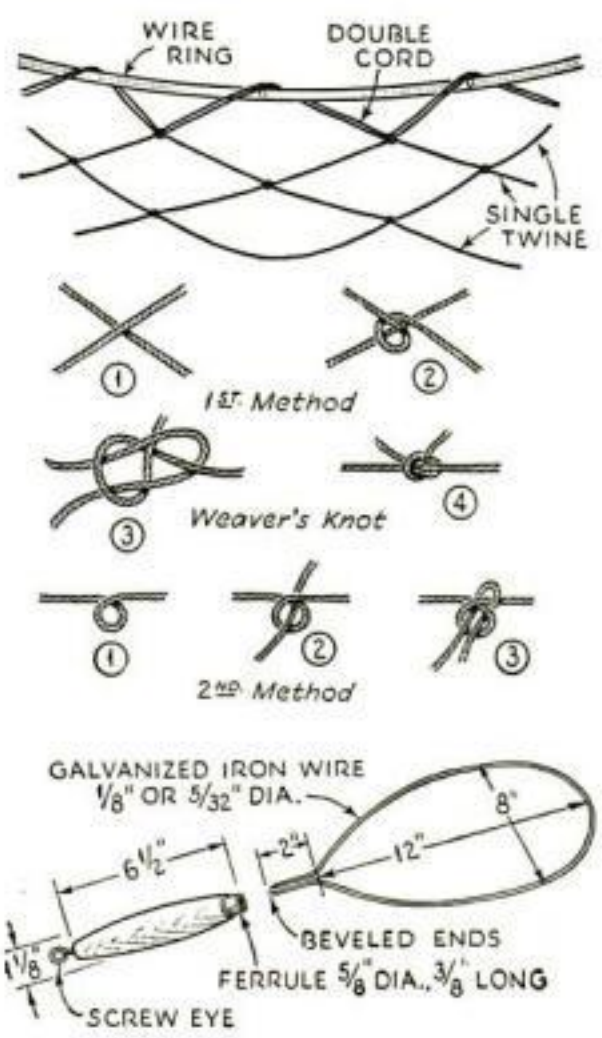
Ring and Handle. The finished net ring should be egg-shaped and about 8 in. wide by 12 in. long. Grind a bevel ½ in. long on the outside of each end. Turn or shape the handle as shown and paint it.

Net. Take some heavy wrapping twine and practice tying the knot that is to be used. This is the familiar knot variously known as the weaver's knot, thumb knot, becket hitch, or common bend.

To tie it as weavers do, first cross the ends of two pieces of twine with the left over the right and hold them with the left thumb and forefinger where they cross; then, with the right hand, bring the long part of the right twine up over the left thumb, down under its own end (which is projecting to the left), and up between the two ends over the cross. Hold it with the left thumb while you slip the loop that is over the thumb forward to raise it. Push the short end of the left cord (which is projecting to the right) back through the loop; now draw the knot tight by pulling both long parts.

The net is fastened to the ring by a double strand of twine. Cut off a piece about 12 ft. long and double it back to make a 6-ft. strand. Take a single piece of twine 3 or 4 ft. long and lay it out in front of you with the long end to the left. Lay the doubled cord out with the long end to the right. Tie a knot to unite the single and double twines, leaving the ends about 4 in. long. Swing both long parts to the right, and 2 in. to the right tie another knot. Continue this with a knot every 2 in. until you come within 4 in. of the end of the doubled twine.

An easier way to tie all knots after the first one is the second method illustrated. Make a small loop or eye in the double twine at the proper point by turning the long part of the twine up over the shorter end; pass the end of the single twine down through the loop, up behind both parts of the double twine, over the right end, down around and up through the loop again. Then pull the single twine through until only 2 in. remains at the left, and draw tight by pulling on all four ends or sides at the same time.



When all knots are tied, you will have a series of loops, double on one side and single on the other, through which you now pass the tying ring. Slip the tiny rings on to fasten the ends of the large ring, and spread the twine around the ring evenly. Now tie the 4 in. ends of the doubled twine loosely and suspend the whole from the ceiling.

The rest of the net is made in the same manner as the first loops, except that single twine is used throughout and the space left between knots is only 1¼ in. When the net is deep enough (about 12 in. for the wading net), make the loops slightly shorter (about ¼ in.). Skip a loop, tie four or five loops, and skip another; do the same on the other side of the net about opposite the first skip. To skip a loop, make the twine between two ties only ½ in. long and on the next time around do not tie in this space. When the bottom of the net has been shaped and closed, any large spaces that may be left can be filled by tying a short piece of twine.

Transfer the net from the tying ring to the net ring, untying the loose knot in the double cord. Insert the wedge points of the ring in the handle and drive them home. Tie the double cord again with a solid knot, and attach the carrying device.

May 1935

NATIONAL GUILD EXHIBITION

Speeds Growth of the Home Workshop Hobby

Cheyenne (Wyo.) Club exhibition and members. Front row, left to right: Henry Derfler, H. Mason, Lief Eskesen, W. F. Winkle, D. R. Kinports, E. L. Kopp, Jr. Back row: R. Tipton, W. C. Winkle, J. Sargent, Sam Lawson, and Henry Arp

SPURRED on by the nation-wide publicity that attended the preparations for the first great National Handicraft Exhibition and Contest of the National Homeworkshop Guild in Chicago, March 25 to 30, the amateur crafts movement has gained more momentum in the last few months than in any past period of history.

Since the plans for holding the exhibition were first announced in this magazine (P.S.M., Aug. '34, p. 74), sixty new clubs have been organized and chartered by the Guild. This brings the total number of clubs in the Guild to 156. Of equal, if not greater, significance is the steady increase in membership reported by practically all the local clubs. Not only are new members coming in, but the clubs are expanding their activities far beyond anything that could have been anticipated when the Guild was started.

There have been innumerable new achievements in every field of activity relating to the National Homeworkshop Guild—membership, projects under way, club programs, junior auxiliaries, publications, community work, and courses of instruction. Many columns could be filled each month with these reports.

Silver cup to be awarded at National Exhibition for veneering and inlaying and, at left, the trophy for the best project in decorative metal

The first annual exhibit of the Beckley (W. Va.) Homecraft Club

This issue goes to press before the opening of the National Guild Exhibition, but a full account will be published next month. At that time there will also appear a list of awards in the ten divisions of the national contest, the prizes for which are ten cups and trophies and $2,000 in cash. Because of the dominant position now occupied by the Guild in the home workshop field, these awards are the greatest distinction that can be won by amateur craftsmen.

The national significance of the contest and the value of the awards made the selection of the judges a matter of unusual importance. As announced last month, the judges were chosen entirely outside the Guild itself in order to insure absolute independence and impartiality. The names of the judges are given in the list below, together with the officers of the Guild, the Advisory Council, and the contest and exhibition committee.

The following fifteen clubs have been granted charters since the April issue was published: Mt. Clemens Homeworkshop Club, Mt. Clemens, Mich.; Bluefield Homeworkshop Club, Bluefield, W. Va.; Fayette Homeworkshop Club, Fayette, W. Va.; Nampa Homecraft Club, Nampa, Idaho; Mound Builders Homeworkshop Club, Newark, Ohio; Dunkirk Homeworkshop Club, *(Continued on page 89)*

WHO'S WHO *in the* GUILD

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Robert A. Horner, *vice president*
E. Raymond DeLong, *secretary*
L. B. Achor, *treasurer*
M. Allen Warren, *counsel*

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Howard Vincent O'Brien
Donald A. Price
Lorado Taft
Thomas E. Tallmadge
L. W. Wahlstrom
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Alexander Maxwell
Clyde Newman
Earl G. Peek
LeVern T. Ryder
Wallace Scherer
Arnold Schultz
H. DeVere Shaw
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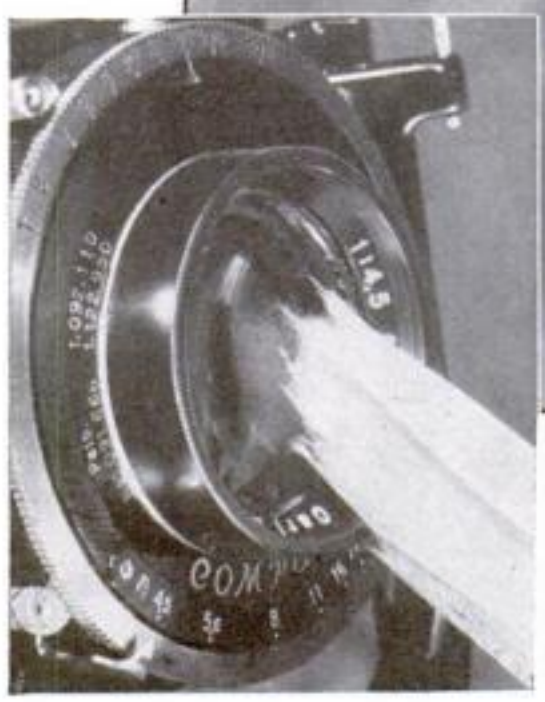
Donald Stow
Preston Straley
James Voyce
W. O. Watkins

WHAT YOU NEED TO KNOW ABOUT

Cleaning a Camera Lens

Best way to remove the dust film that causes foggy pictures . . . Why a bad scratch does very little harm

By FREDERICK D. RYDER, JR.



To inspect lens, hold it so that the light does not shine directly into your eye. *Left:* Brushing dust away with fibers on torn end of lens-cleaning tissue

"WHAT are you photographing today?" I inquired of a friend I met one morning recently, as I glanced down at the camera case dangling from his hand.

"I'm not taking any today, thank you," he grinned. "The lens on this camera is no good—can't get a clear picture with it—so I'm going to trade the outfit for one with a better lens."

He opened the case and I found that the camera was equipped with an anastigmat lens of one of the less expensive types. I doubted his statement that the lens was no good, so I suggested that it might be well to give the lens a real test before spending money on a new outfit. He agreed to bring it around that night.

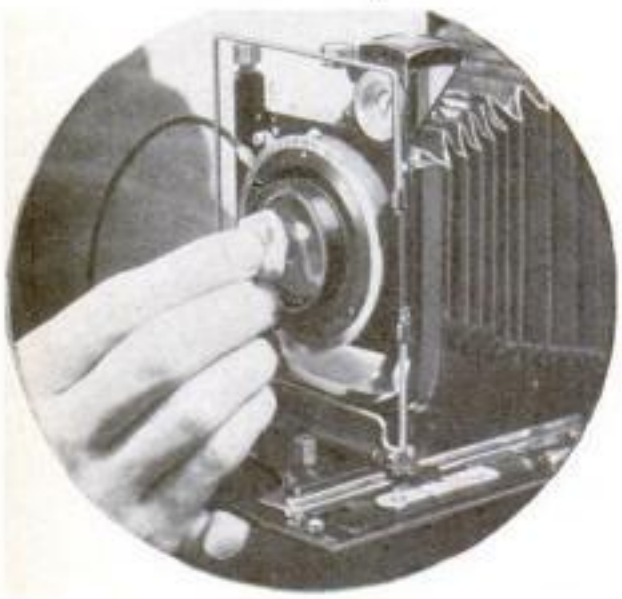
Before making a test exposure, I examined the lens carefully and discovered that the inner surfaces of both front and back elements were badly fogged. There was also a heavy layer of dust on the back surface of the lens. Testing was hardly necessary after that because the negatives and prints he had brought along showed clearly that they'd been taken with a dirty lens. They certainly were dull, flat, and hazy looking—the kind of a view you see through a very dirty window or through your eyeglasses when they are smudged and covered with dust.

In contrast with this fellow, I have met men who were so fussy on the subject of clean lenses that they wouldn't think of taking a picture if there were so much as a single speck of dust visible on the glass. Others seem to have the impression that a scratch on a lens is fatal to good pictures because it spoils the defining qualities of the lens and results in bad fuzziness.

Suppose we dug a deep scratch with a diamond right across the center of the front surface of a lens that is otherwise perfect. The scratch would naturally play hob with every ray of light that actually struck it, but the actual area of the scratch would be many hundred and perhaps thousands of times less than the area of uninjured glass. The strength of the stray light caused by the scratch would be in the ratio of one to several hundreds or thousands as compared with the true image light. It is therefore quite evident that the effect of one bad scratch would be, practically speaking, nothing at all when the lens is used with the diaphragm wide open. If the scratch were very wide and deep, there might be a slight fogginess in pictures taken with the smallest diaphragm opening. And if you were to take a picture with a badly scratched lens like this in the bright sunlight in such a position that the rays of the sun hit the scratch directly, the fogging effect would be vastly increased.

In any case, if the scratch were carefully filled with black paint, the lens would be to all intents and purposes as good as ever, although you might find it necessary to increase the exposure at the smallest stop by a trifling amount.

What does cause a real falling off in the picture clearness is to spoil the polish of the glass with millions of tiny, almost invisible scratches such as are produced by too much scrubbing of the lens surface with a dirty, gritty handkerchief.



When the dust is removed, breathe on the lens and wipe it circularly with new tissue

Dirt on a lens has much the same effect as scratches. A few dust particles scattered over the otherwise clean surface of the lens are of no importance whatever. Poor pictures are caused by a thin layer of fine, powdery dust that gives the glass a dull, lifeless appearance. A clean lens surface is almost invisi- *(Continued on page 95)*

How to Copy a Framed Photo

EVERY amateur photographer is faced, now and then, with the task of copying an old framed photograph. If no dust has sifted through the cracks in the frame and the picture appears clear and clean, the copying can be done without disturbing the frame. Set up the photograph on a table, place two lights of equal power as shown, and have the rest of the room in comparative darkness. The sharp angle at which the lights are placed will avoid any direct reflections. Don't stand right behind the camera while making the exposure unless you are dressed in dark clothing. Keep the exposure on the low side, especially if the photograph is light in color and considerably faded.

MINIATURE KODAKS FOR SPEED

TODAY MINIATURE CAMERAS are the last word in photography. And no wonder they're so popular. With these small, fast cameras you're ideally equipped for action pictures, candid photos ...for all types of snapshots.

A miniature is truly an all-around camera. Small enough to be kept handy, these Kodaks go into action at the touch of a button ... and their high-speed shutters and lenses give you full control of almost any picture situation.

KODAK DUO SIX-20

...the miniature camera that gives a larger picture.

In the rain ... indoors ... almost anywhere, the crisp, sharp *f*.3.5 lens lets you take pictures. And the Compur shutter gives you speeds up to 1/300 second—fast enough to "stop" an express train.

Just a handful of camera, this miniature Kodak makes sixteen pictures on a roll of 620 film. And each picture is 1⅝ x 2¼ inches, big enough for your album. Complete—Kodak Duo costs $52.50.

KODAK RETINA

A 36-exposure, precision, miniature Kodak—at half the price of similar cameras

KODAK RETINA—Here's the latest thing in miniature cameras ... Kodak Retina. You'll find all the most desirable features incorporated in this tiny Kodak—yet it costs about half as much as other cameras of similar range.

Its Compur shutter has *extra* speed—up to 1/500 second ... and a brilliant *f*.3.5 lens admits ample light for fast exposures—or lets you make "candid" pictures in artificial light.

The Retina uses either high-speed Kodak "SS" Film or fine-grain Kodak Panatomic Film. Both come in daylight-loading magazines. Easy loading is one of the prime features of the Retina. Just lift the hinge back and you can load this tiny camera as simply as a Brownie.

Kodak Retina is a high-precision camera with a low film cost per picture ... gives you 36 exposures (24 x 36 mm.) on each roll of film.

A film-winding device automatically counts the pictures you make—prevents overlapping, no wasted film is possible. Complete, with optical finder, depth-of-focus scale, plunger-type shutter release—the Retina costs but $57.50.

KODAK MINIATURE ENLARGER

With a Kodak Miniature Enlarger to supplement your tiny camera, you can get the full fun out of miniature photography.

This new enlarger is built especially to the exacting precision standards so necessary where diminutive negatives are to be used. Prints of astounding size can be made from little negatives—for instance, a 1 3/16 x 1 9/16-inch negative can be "blown up" to 11 x 14 inches ... 100 times the original area.

An automatic masking device holds the paper secure ... a paper cabinet base is optional equipment. Price for enlarger, paper holder, Anastigmat *f*.4.5 lens—$67.50. Paper cabinet base, $10 extra.

FREE! a valuable folder—and a handbook on enlarging

This new folder tells you what the miniature Kodaks and enlarger will do, what films to use. The 38-page booklet gives complete instructions on enlarging ... data on bromide papers, development formulas. Send for them today. Eastman Kodak Company, Rochester, New York.

Name_____

Address_____

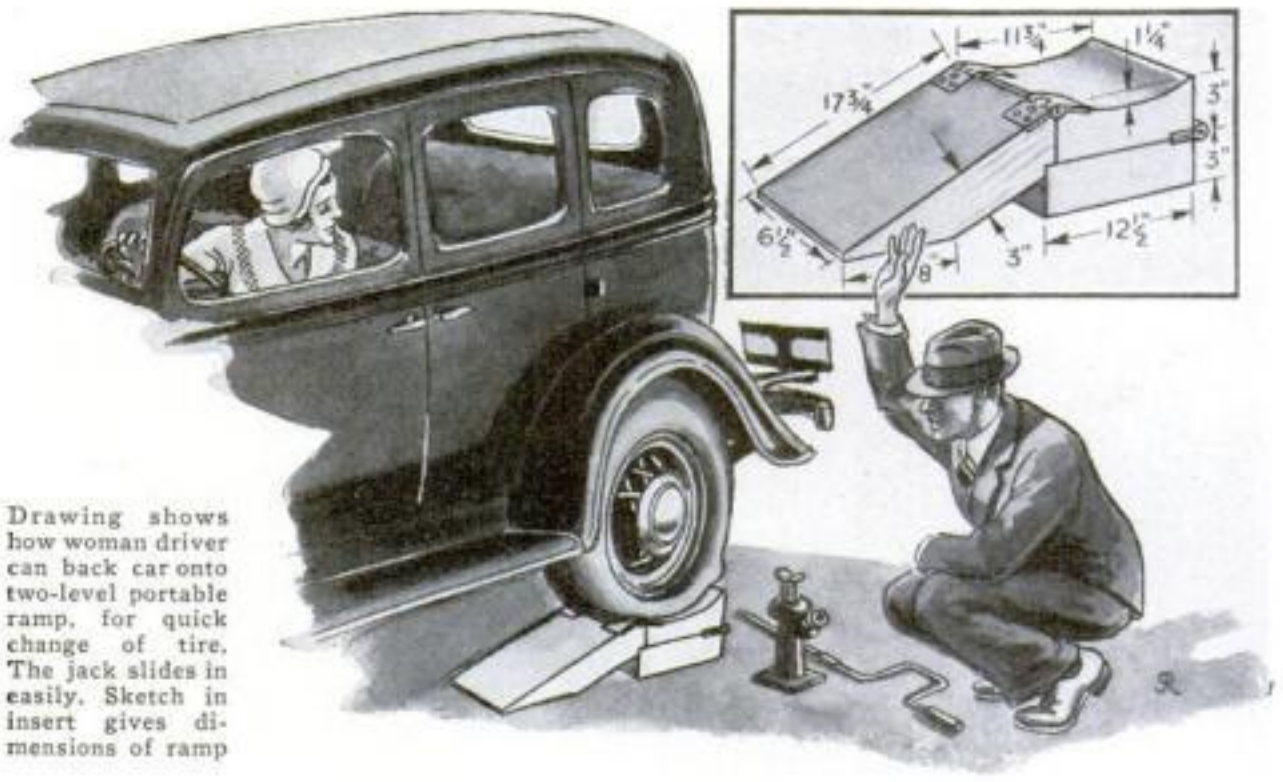
City_____ State_____

P. S. 5-35

Helpful Kinks *for* Your Car

A Clearing House for Ideas that Readers Have Found Useful in Caring for Their Cars

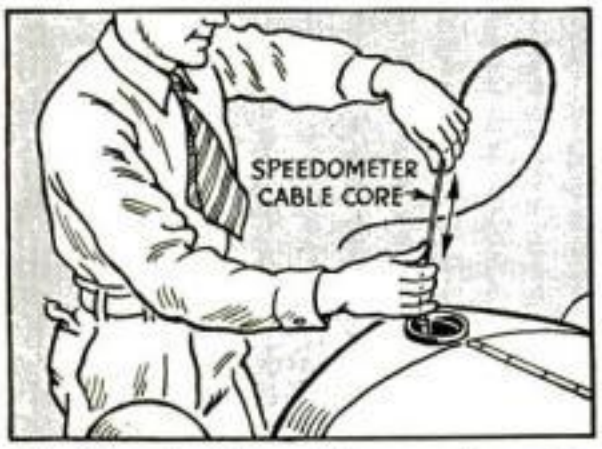
GETTING a jack under the average low-slung modern car presents a real problem. However, with the easily made portable wheel ramp shown, it is as easy as backing up a hill. Folded, the ramp can be stowed away under the front seat. Open, it provides just the right incline to lift the wheel and allow the jack to be eased into place. Because it is constructed in three sections, two heights are available. Choice depends on the purpose to be served.—B. B.



Drawing shows how woman driver can back car onto two-level portable ramp, for quick change of tire. The jack slides in easily. Sketch in insert gives dimensions of ramp

Cleaning Overflow Pipe

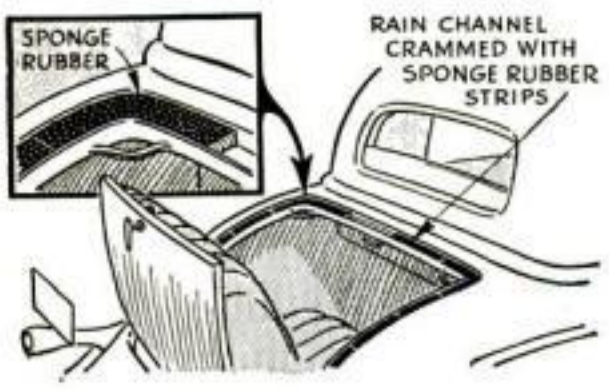
FOR cleaning a radiator overflow pipe, the thin braided wire core from the inside of an old speedometer cable forms an ideal tool. Simply cut off one of the solid ends and feed the cable into the pipe from the top. Being flexible, it will slip into the pipe easily and its sharp end will cut through any scale or sludge that may be causing the stoppage.—E. J. N.

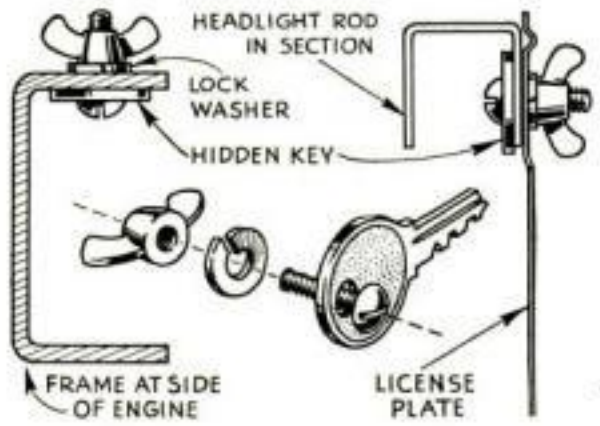


Flexible wire clears radiator overflow pipe

Seal for Rumble Seat

TO PREVENT rain, cold air, and dust from seeping into the rumble seat of my roadster when the cover is down, I formed a seal by making use of sponge rubber in the manner shown in the illustration. The sponge rubber I obtained by purchasing several ten-cent knee pads. Cut into strips and stuffed into the rain channel it forms an excellent dust-proof washer or gasket when the rear deck is closed.—S. D. B.





Hiding Spare Key

INSTEAD of leaving the spare keys to your car at home, hide them on the outside of the car where they will be handy when you want them. By means of a small bolt, a lock washer, and a wing nut, they can be fastened to any one of the number of hidden holes that spot your spare-tire carrier, your trunk rack, license-plate bracket, or the frame of the engine under the hood. To keep the keys clean, wrap them in a piece of oilcloth before placing them on the bolt.—E. E. S.

Tire-Chain Tag

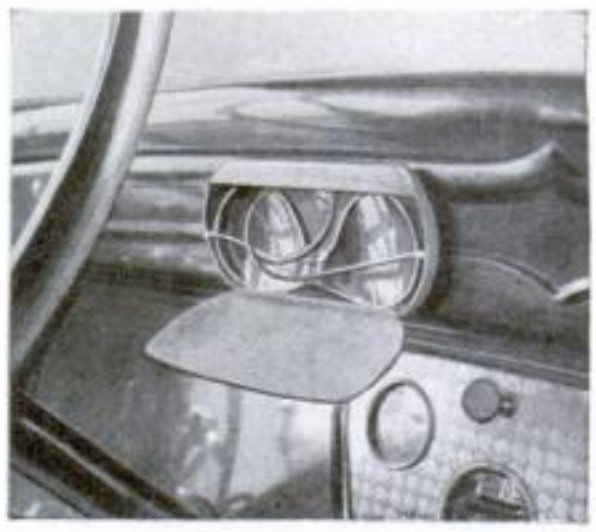
YOUR chances of losing one of your tire chains will be greatly reduced if they are fitted with simple identification tags like the one shown. The plate can be of brass or aluminum or any similar metal and the printing can be embossed upon or scratched into the metal with a nail, a punch, or an awl. Brass repair links will serve admirably to attach both ends of the tags securely to the side chains.—G. A. I.

Dashboard Watch Holder

HAVE you often wished for a clock in your car? By fastening two suction cups together with a U-shaped piece of tin or brass, you can make a handy flexible holder that will allow you to mount a "dollar" watch on the dashboard. To make the two suction cups stick fast, wet them with glycerin instead of water.—E. F. S.

Handy Goggle Holder

AFTER mislaying and breaking more than a half dozen pairs of driving goggles, I hit on the idea illustrated below. The case was fastened to the dashboard by removing one of dashboard screws and replacing it through a small hole drilled in the bottom of the case. For convenience, the case was mounted with the hinge toward the bottom, making it possible to remove or replace the glasses with one hand. Incidentally, the case also provides a handy place for storing an extra package of book matches.—A. E. MacN.



This Ford Policy

HAS *NEVER* CHANGED

Piston Pins must not fracture until the load exceeds 5 tons.

Model A replacement Pistons withstand a 5-ton crushing pressure.

FROM the very beginning, Mr. Ford believed that after he sold an automobile he was obligated to furnish repair parts at the lowest possible price—and to make those parts as good as he knew how.

He adopted this policy in 1903 when he founded his own company. It has been in effect ever since.

The Ford Motor Company still supplies repair parts for the Model T. Thousands of these cars are continuing to give satisfactory operation. Replacement parts are manufactured in quantity for Model A Fords, many of which have passed the 100,000-mile mark.

Applying a 10-ton shearing load to a single tooth in Ring Gear.

Parts for these past model Fords are held to the same standard of precision used when these cars were in production. The bars have never been let down on close limits or on quality—frequently quality has been raised.

All Ford materials undergo strict laboratory tests

Recently developed heat-treating processes used for Model A replacement pistons result in better wearing qualities than the original pistons had. Model A valves are now made of a new material which is warp-proof against the higher heat of 1935 engine fuels.

And so it is with V-8 parts—new developments in manufacturing, testing and inspecting are constantly being adopted to insure higher quality and greater uniformity. Regardless of the model you own, Genuine Ford Parts will prove most satisfactory for your car. They are available everywhere at low price.

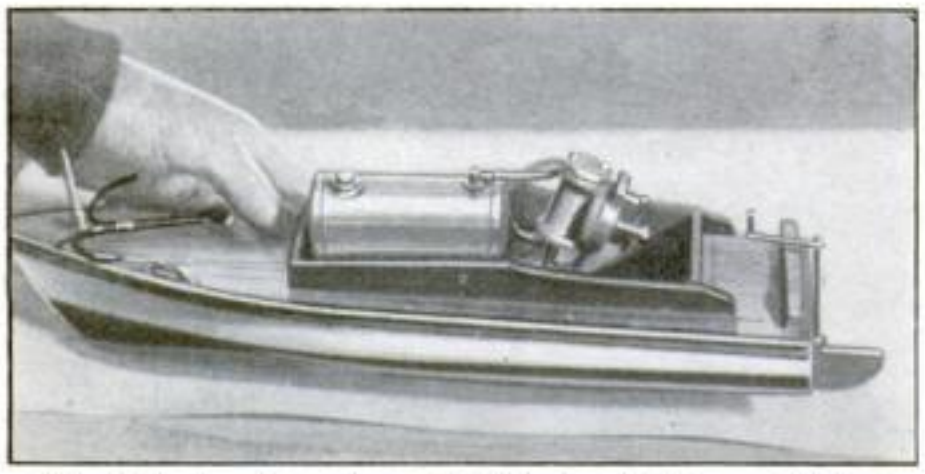
You wouldn't buy a car built of makeshift parts. Why gamble with replacement parts in the car you own. Use only Genuine Ford Parts for repairing Ford cars and trucks. Buy where you see the familiar Ford oval.

GENUINE Ford PARTS

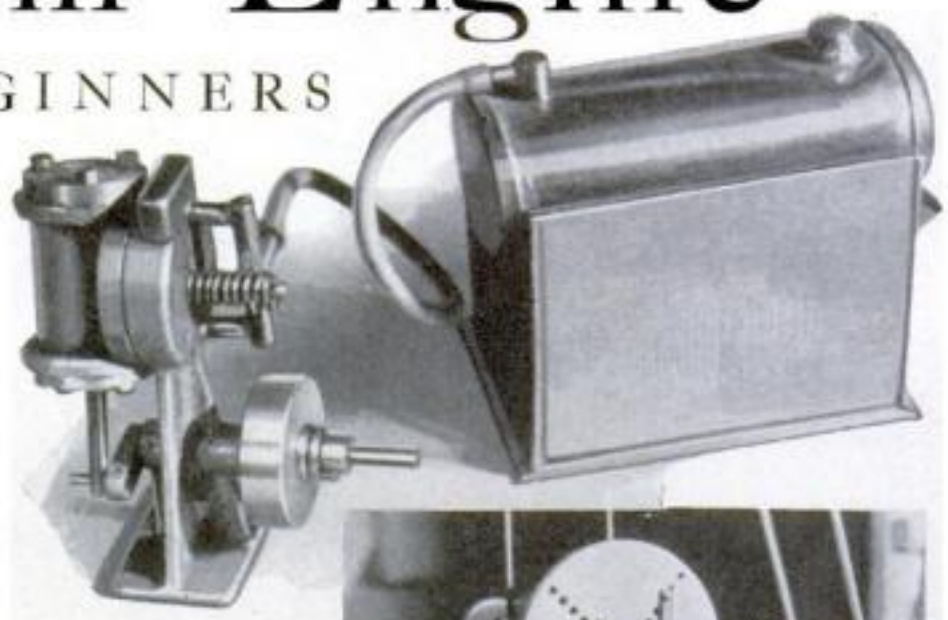
FORD MOTOR COMPANY, DEARBORN, MICHIGAN

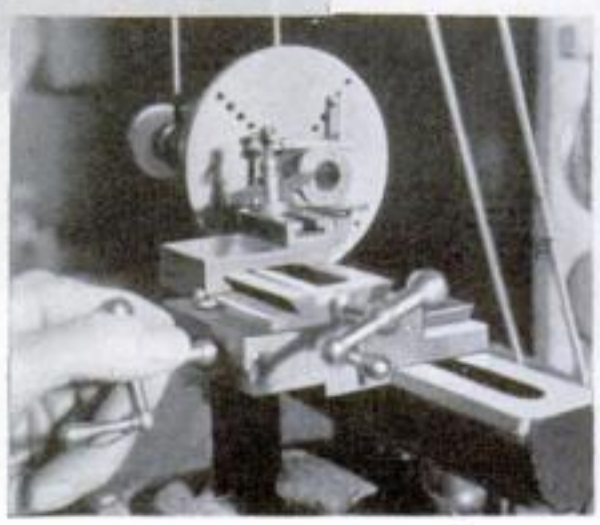
Model Steam Engine

SIMPLIFIED FOR BEGINNERS

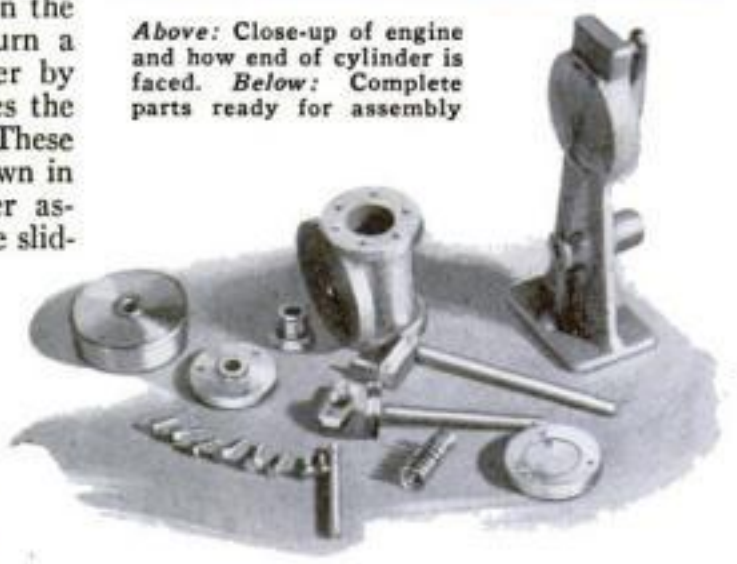


The finished engine and a small boiler installed in a model boat 18 in. long. The engine itself is only a trifle over 3 in. high





Above: Close-up of engine and how end of cylinder is faced. *Below:* Complete parts ready for assembly



Can be built without a lathe if necessary, and without castings if you have brazing equipment

By C. K. Fankhauser

AFTER a fruitless search for plans for a very simple model steam engine that could be built with the average home workshop equipment, I finally designed and made this double-acting, oscillating type model.

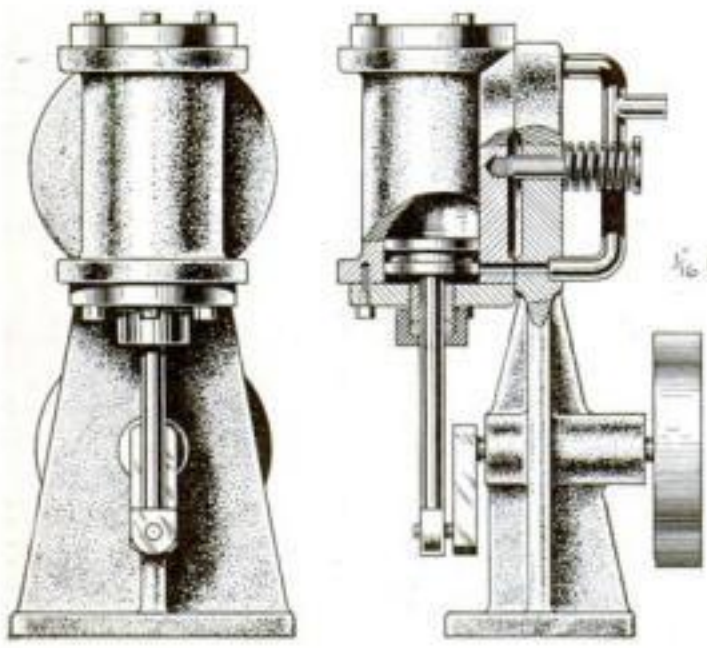
The engine stands a little over 3 in. high, has a base 1 by 1½ in., a bore of ½ in., and a stroke of ¾ in. It will operate satisfactorily on either a pot or a flash boiler and has sufficient power to drive a fair-sized model boat.

The base and cylinder are brass or bronze castings, which any brass foundry should supply from your patterns at a very moderate cost. White pine or mahogany may be used in making the patterns, with fillets of wax. Allow 1/16 in. for machining on surfaces that are to be finished.

To make the cylinder pattern, turn the cylinder from solid stock. Then turn a disk of wood 1 5/16 in. in diameter by ¼ in. thick. (This thickness includes the 1/16-in. allowance for machining.) These two pieces are fitted together as shown in the drawing of the finished cylinder assembly. The 1 5/16-in. disk forms the sliding surface on which the cylinder oscillates.

The pattern for the engine base and frame can be built up of several pieces and filleted with wax.

The cylinder may be cast solid and drilled out to ⅜ in. on a power drill press, then bored to finished size on the *(Continued on page 84)*



HOW ENGINE IS CONSTRUCTED

Detail drawings of all principal parts—the base and frame, cylinder, piston and rod, and crankshaft—and two assembly views, one being partly broken away to show the construction. The bore is ½ in., stroke ¾ in. While not complicated, the model will give an amateur mechanic excellent practice in pattern making and machine work

An Announcement

3,000,000 MOTORISTS HAVE WANTED TO HEAR

Today all Summer grades of Mobiloil are made by famous Clearosol Process

THIS ANNOUNCEMENT will have a vital effect on America's motoring bill.

For today all Summer Mobiloils are made by the same Socony-Vacuum Clearosol Process that produced the new Mobiloil Arctic, used by 3,000,000 motorists last winter.

Tests reveal amazing differences between the new Mobiloil and another leading oil. Tested for consumption, Mobiloil registered 98% resistance; the other oil 88%. For gumming, Mobiloil showed 100% resistance; the second oil 68%. Tested for thinning, Mobiloil's resistance was 100-*plus;* competing oil's 38!

Only one factor makes this superiority possible. The Clearosol Process *cleanses* crude oil of impurities that "burn up," form carbon and gum, and thin out under heat.

Take advantage of refining's latest development yourself. There's no advance in price for this new Summer Mobiloil!

SOCONY-VACUUM OIL COMPANY, INC.

AFTER 100 HOURS' operation on ordinary oil, piston rings were badly stuck with gum. This was formed by impurities left in the oil by old-type refining methods.

AFTER 100 HOURS on new Mobiloil, piston rings and entire engine were clean. That's because this new Mobiloil is a practically 100% dirt-free lubricant.

75,000 dealers all over the country are now ready with new Summer Mobiloil, made by Clearsol Process. In grades for all cars . . . Mobiloil A, AF, B and BB.

Mobiloil

SOCONY-VACUUM

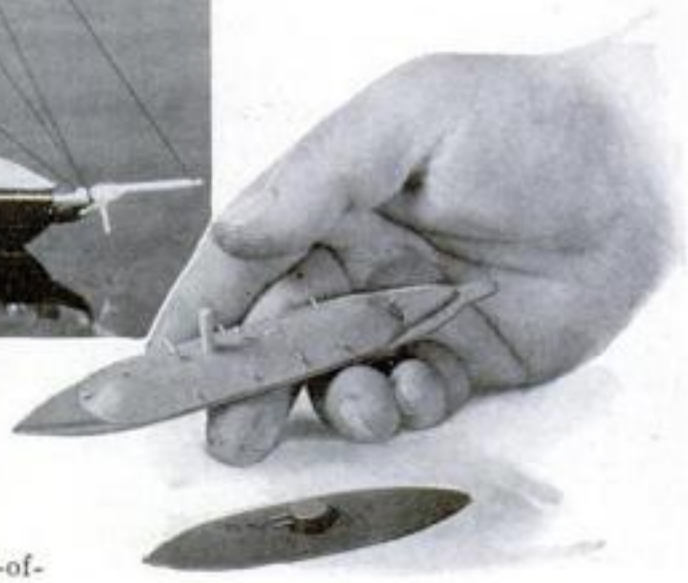
MINIATURE MODELS OF

Three Famous Civil War Ships

Farragut's *Hartford*, the Confederate ironclad *Merrimac*, and the Union *Monitor*, known as Ericsson's "cheese box on a raft." All are built to the same scale

MODEL-OF-THE-MONTH CLUB PROJECT NUMBER TEN

Designed by Theodore Gommi



THIS month's project in our Model-of-the-Month Club series is the construction of miniature water-line models of three Civil War vessels—Admiral Farragut's *Hartford*, the famous little *Monitor*, and the Confederate ironclad *Merrimac*. All are built to the scale of 1 in. equals 50 ft. so that they appear in correct proportion to each other and to the modern fighting ships previously presented in this series, such as the *Saratoga* and *Tuscaloosa*.

The *Hartford* represents the period of transition between sailing vessels and steamships and also the last period of the wooden ship. The *Monitor* and the *Merrimac*, on the other hand, mark the beginning of the new era in warship construction. The present all-big-gun ships can still be classified as seagoing turret vessels, just as the *Monitor* was classed in 1862 when she was built for the United States Navy from plans prepared by Captain Ericsson. From its one turret with two small guns to a modern warship's four turrets with twelve 14-in. guns, has been a matter of progressive development based upon the features first found in the *Monitor*.

When built on so small a scale, the *Monitor* is certainly the simplest of all ship models. The materials are given in one of the accompanying lists. Instructions are hardly necessary, but take care to have the shape of the hull absolutely symmetrical. The entire unit is painted black.

The materials for the *Merrimac* are given in another list. It should be noted that fore and aft the slope of the sides comes to an end at the line where part *C* touches *B*, but at

List of Materials

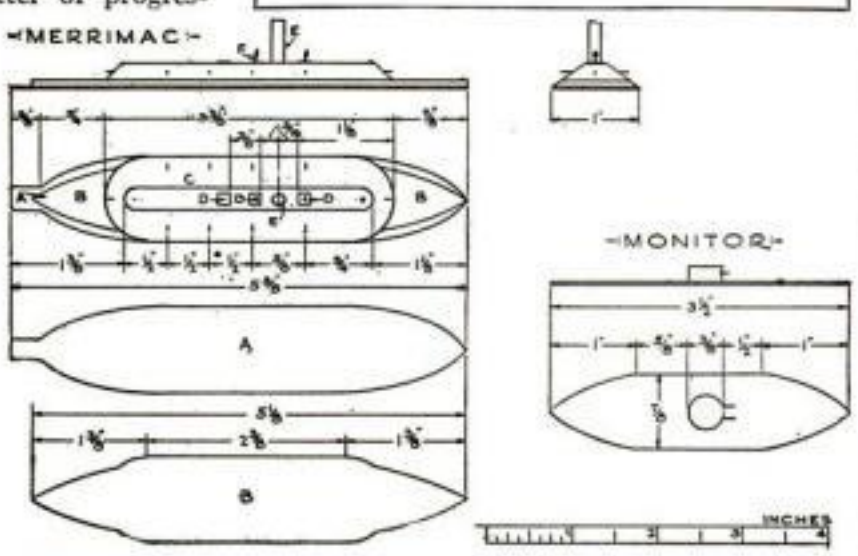
Monitor

No. of Pieces	T.	W.	L.	Material
1	1/32	7/8	3½	Balsa for hull
1	3/8 (round)		3/16	Dowel for turret
2			½	Pins (heads removed) for guns

Merrimac

No. of Pieces	T.	W.	L.	Material
1	1/32	1	5 3/8	Balsa for A
1	1/16	1	5 1/8	" " B
1	3/16	1	3 3/8	" " C
3	1/64	1/8	1/8	Fiber for D
1	1/8 (round)		5/8	Dowel for E
2			½	Pins for F
10			½	Pins (heads removed) for guns

NOTE: All dimensions are in inches.



How to build the *Merrimac* and *Monitor*. The reference letters may be readily identified by studying the list of materials above

Materials for *Hartford*

No. of Pieces	T.	W.	L.	Material
1	3/16	⅞	5⅛	Balsa for A
1	¼	⅞	¾	" " B
1	3/16	⅞	1	" " C
2	⅛	⅛	½	" " E
1	1/64	½	⅝	Fiber for F
5	1/64	⅛	⅛	" " H*
2	1/64	⅛	¼	" " I*
25	1/64	1/16	⅜	" " J*
1	1/64	3/16	¾	" " M*
6	1/64	⅛	3/16	" " P

MISCELLANEOUS

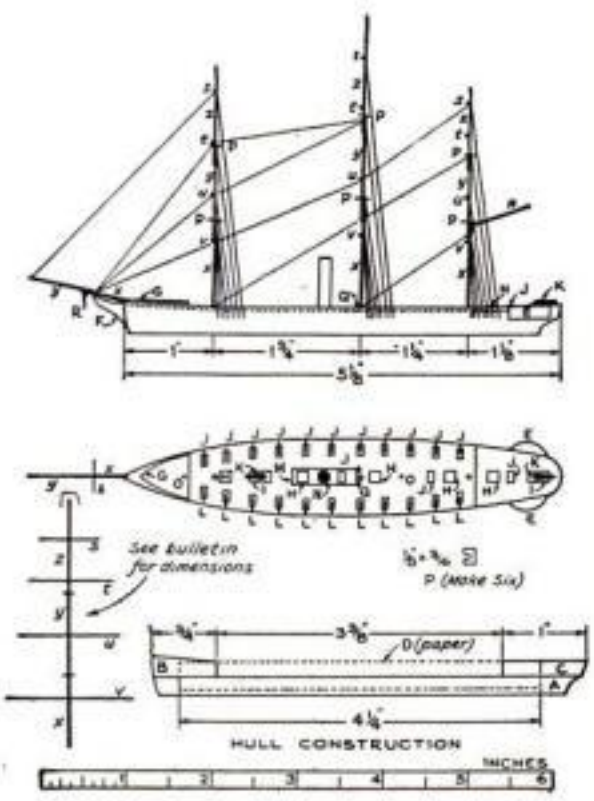
Twenty-seven round wood toothpicks for K and L; 1—⅛-in rd. dowel ¾ in. long for N; 2 pins ½ in. long for Q; 2 tiny black beads for O; 2 pc. heavy white paper 5/16 by 4¼ in. for D; 1 pc. thin wire about 3 in. long for R and G; 1 pc. stiff wire about 3 ft. long for S, T, U, V, X, Y, Z; 1 pin about 1 in. long for W; 1 spool black cotton thread No. 100 for rigging; about 6 in. white thread for stripe.

Black, white, buff, dark brown, and gray paint (mix brown and white to get buff, black and white to get gray); glue and sandpaper.

NOTE: All pieces marked with an asterisk (*) are ready for final assembly when cut to the given dimensions. All dimensions are in inches.

the sides amidships the slope continues through *B*, as shown in the cross section. The ventilators are bent pins, and the conning tower is simply the head of a large pin. The entire model is painted dark gray.

The *Hartford* requires more care and patience, but should offer no difficulty to even the most inexperienced model maker. A long bulletin containing complete step-by-step instructions has been prepared especially for the Model-of-the-Month Club. Any reader, however, can obtain it, together with full-size drawings of all three models, by sending 25 cents for our new Blueprint No. 258. Registered members of the club are entitled to a free copy of the instructions alone (not the blueprint), provided they send a self-addressed, stamped envelope and ask for Model-of-the-Month Bulletin No. 6.



The *Hartford*. Full-size drawings and complete instructions can be had for 25 cents

MODEL TORPEDO TUBES

TORPEDO tubes for a large destroyer model may be made from three lengths of small curtain-rod tubes, placed seams downward and soldered underneath. Cut off the mouth at the correct slant.—CHARLES L. JOHNSON.

PHOTO TRANSPARENCIES DECORATE LAMP SHADE

A UNIQUE way to display six or more of your best snapshots is by incorporating them in a photographic lamp shade like that illustrated. It appears colored when the light is turned on, and is at once decorative and mystifying.

The first problem is to obtain a suitable wire lamp shade frame having a number of flat sides. Then select appropriate negatives and prepare enlargements of the proper size and shape to fit the segments. In making these enlargements, use the special translucent paper sold for this purpose. It is handled like ordinary enlarging paper. Your photographer or

Lamp shade with photo transparencies that show up in lifelike colors when illuminated

photo-finisher can make these transparencies for you if you lack the necessary equipment.

The coloring, which is applied to the back of the prints, is done more boldly and vividly than on ordinary photographs.

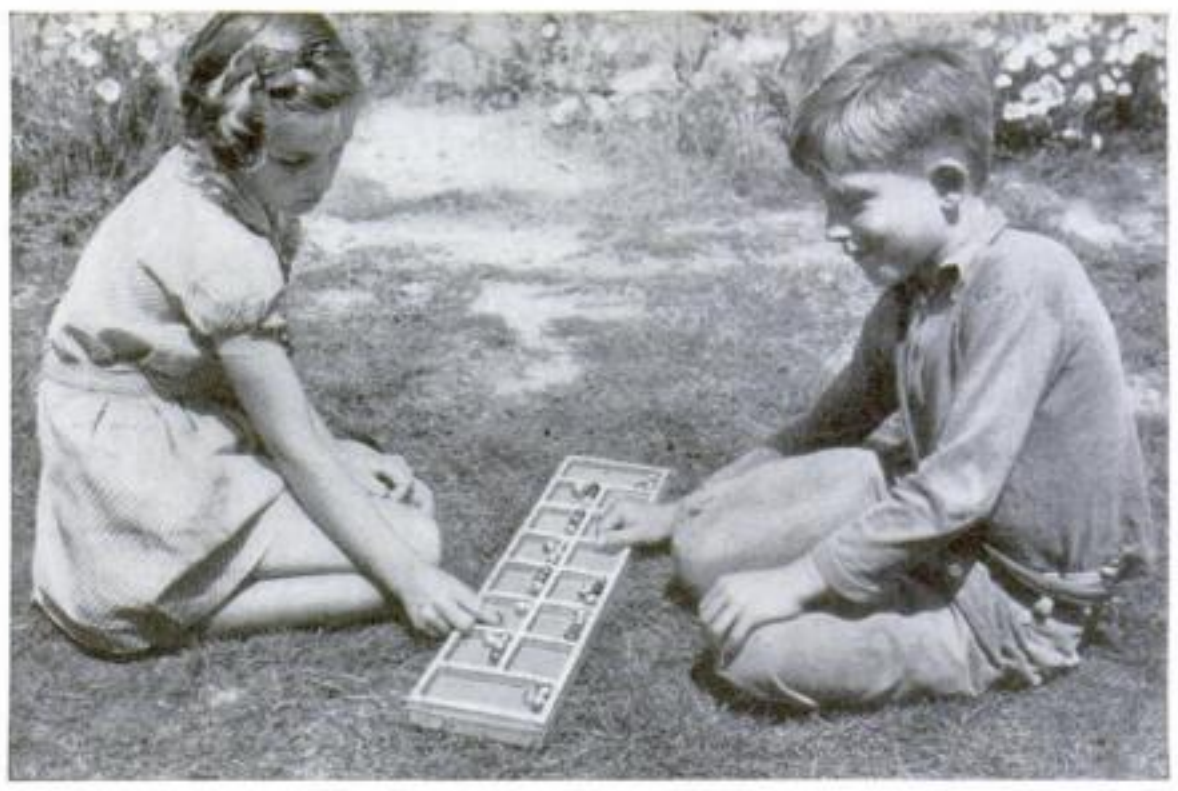
Cut the border from black construction paper. For a hexagonal shade like that illustrated, it is best to make this in two sections of three segments each. Also cut some lightweight bond paper to line the inside of the shade and lend stiffness to the transparencies.

Soak the border, prints, and bond paper lining in clean water until limp. Remove all excess moisture with a blotter or towel. Lay out the border, apply liquid glue to it, place the prints face down over each segment, and press gently. Apply a thin coat of glue to the backs and cover with the damp bond paper. Place between blotters or clean newspapers until dry. This will keep the prints flat.

After the sections are dry, punch holes for the lacing and crease between the segments. Staple or glue the two sections together and lace to the frame with narrow ribbon or silk cord.—LLOYD J. CARTWRIGHT.

RECHUCKING LATHE WORK

WHEN a three-jawed lathe chuck is used for duplicate work and it is necessary to set up each piece several times, much effort is wasted in making sure that the various bores, shoulders, or threads are true and concentric. One way to speed up the rechucking process is to make a uniform practice of inserting the chuck wrench between jaws Nos. 1 and 2 and placing a witness mark on the work at jaw No. 1 by giving the wrench extra pressure. The piece can then be set to run true at any future time, because each jaw of a chuck has its own characteristic mark, like a finger print. Merely turn the piece when rechucking until it is felt to slip into its former position. Then tighten the chuck normally.—T. R. COOVER.

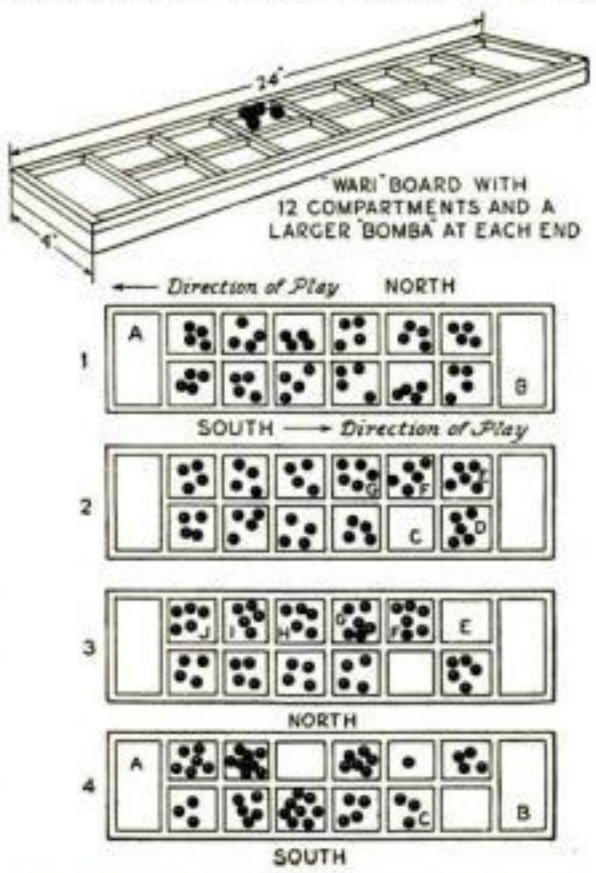


OLD CONGO GAME AMUSES IN NEW FORM

HERE is an adaptation of a very simple but entertaining game popular with African savages and called "wari." They dug holes in the ground and played with smooth pebbles, but the modern version is played with marbles and a board made as shown. The board is 24 in. long, and 4 in. wide. It has twelve compartments, each 2 in. square, formed with ¼ by ¼ in. strips, and two larger ones at each end.

Two persons only can play, North and South, seated on opposite sides of the board. Forty-eight marbles are then distributed as shown in diagram 1. It will facilitate play if two colors of marbles are used, one for each player.

The compartment, or "boma," marked *A* is the home of marbles captured by North, and *B* of those taken by South. Play is always toward the right. The players own the marbles on their respective sides at the start of play. Assuming South has the first turn, he may take the marbles from any one of the compartments on his side, but he must take *all* in the chosen compartment, and distribute them, one each into the compartments to the right of him. For example, he takes the four marbles from *C* (diagram 2) and drops one each in *D,E,F*, and *G*. North takes his turn, perhaps choosing the marbles in *E*, which he distributes to his right, one each into *F,G,H, I*, and *J* (diagram 3). Thus the play continues until one or the other finds upon dropping the last marble of any turn, it leaves that particular compartment with either a three or a two in it. In this case, he is allowed to put these in his boma, as a gain. For example, in diagram 4, three marbles are left in *C*, by a play by North, who is entitled to keep them in his boma *A*, as a gain. If there had been two marbles in the kraal or compartment before it (to the left), he could have taken these two as well as the three in *C*. Or had they been reversed—that is, two marbles in *C* and three in the one to the left—he could have captured all five. Players may confiscate marbles from their opponent's or their own side of the board when the foregoing combinations appear.—HI SIBLEY.



How the board is laid out and four diagrams illustrating the method of moving the marbles

CEMENT MAKES SCREWS HOLD

WOOD screws can be made to hold structural parts together with greater strength by making use of the following kink: After drilling a hole for the screw, inject into it a small quantity of the household (celluloid) variety of cement; then drive the screw home. After it has dried well, the cement forms a hard casing for the screw threads, and it also resists moisture.—O.B.

PURE RUBBER CEMENT CHEAPLY PREPARED

PURE, transparent rubber cement of the so-called "artists' grade" can be made with a quart of benzole (not benzine) and two or three bunches of rubber bands costing five cents each. Choose the type of bands labeled "pure rubber" and allow them to soak in the benzole for a week or ten days until the solution is of the consistency of syrup. Should inferior rubber bands be used, it may be necessary to add several ounces of carbon disulphide to make them dissolve quicker.

Besides being useful for ordinary paper-cementing jobs, the rubber cement is especially suitable for mounting photographs perfectly smooth and flat.—G. S. G.

HINTS ON GET-AWAY

(Continued from page 58)

"Another mistake many drivers make is to shift to high gear from second too soon. That's another thing that depends on the type of car."

"It's too bad there isn't some definite rule you can go by," Williams complained.

"Most likely there is," Gus smiled. "The slide-rule sharps probably have figured it all out on paper. Trouble is, they have to assume a set of fixed conditions and when you're on the road the conditions are always changing. The timing of the gear shifting and the pedaling of the accelerator that would give you the fastest pick-up on the level wouldn't be right on an up grade. You'd have to stay in each gear a bit longer. On a down grade you'd shift quicker. A strong wind would have an effect like grade."

"IF YOU really want to learn to make the fastest get-away from a standing start," Gus suggested, "I'd recommend that you take your car out on some nice stretch of road when the traffic is light and keep experimenting with different timing till you find the one that gets you going quickest.

"Mark off a distance on the road of about 200 feet or thereabouts—the exact distance doesn't matter—and get some friend to time you from the word go at the start to the end of the stretch. The clock will soon tell you when you've got the right combination. And I'll bet that if you do practice that way you'll be able to make a monkey out of any ordinary driver handling the same car—and lots of more powerful cars, too!"

"Sounds like good sense to me," Williams agreed. "I think there's an old stop watch kicking around the house somewhere. I'll dig it out and get busy. So long, Gus!"

"Hold on a minute," Gus said, as Williams was about to step on the starter. "What's the use of going out to practice quick starting till you know your car's in shape for it? The least bit of drag on the brakes, or soft tires even, will make the car sluggish."

"Anything else?" Williams asked.

"Sure, plenty," laughed Gus. "Naturally, your carburetor ought to be tuned up a bit. The best mixture for fast starts is a little bit richer in gas than would be right for touring. It wouldn't be a bad idea to check over the ignition system and make sure you haven't any leaky plugs or wiring and that the automatic spark control is working just right."

"There's another thing," Gus continued, warming up to his subject, "and that is the bad effect of leaky valves and piston rings. A bit of leak at a valve or piston doesn't cut much ice in ordinary running, especially at high speed; but when you want every ounce of power you've got for a quick get-away, leaky valves and pistons do count.

"THEN there's the matter of carbon. With high-test lead gas you may not hear knocks, but just the same too much carbon doesn't help the motor's power any."

"I was going to bring her in and let you look over the motor next week anyhow, Gus," said Williams, "so I guess I'll postpone my quick-starting practice till after that."

"I'll pay particular attention to the clutch, Mr. Williams," Gus smiled as his customer started the motor. "If your clutch slips a bit, fast starting will wear it out in no time."

"First man in here in a long while that hasn't tried to argue with you," observed Joe Clark as Williams drove off. "There's one man I'll bet will keep at it till he's able to do a snappier start than anybody else around here with the same kind of car."

"Guess you're right, Joe," Gus grunted. "And if he ever catches old Angus with his steam pressure down, he'll throw mud in his eye for sure!"

Decorative Mantel Timepiece

MADE FROM CHEAP ALARM CLOCK

By HERMAN HJORTH

A DECORATIVE and expensive looking mantel clock may easily be made from a block of wood, a few pieces of veneer, and an electric or spring-wound alarm clock, which nowadays may be bought at very low cost. The shape and dimensions of the case must, of course, conform to that of the clock. While this case is designed for a square clock, it may be changed without difficulty to fit a round clock.

Obtain for the case a piece of close-grained cabinet wood such as birch, maple, gum, walnut or mahogany. To get the necessary thickness, two or more pieces may be glued together. The joints will not be seen if reeds are cut on the sides as shown. The reeds should be spaced in that event so that the grooves are cut in the center of the joints.

Lay out the design on the block and bore and chisel the hole for the clock. Then saw along the outline and smooth all surfaces with plane, file, and sandpaper. The reeds may now be cut with a scratch stock such as can be seen lying on the bench in the photograph, and finished with sandpaper.

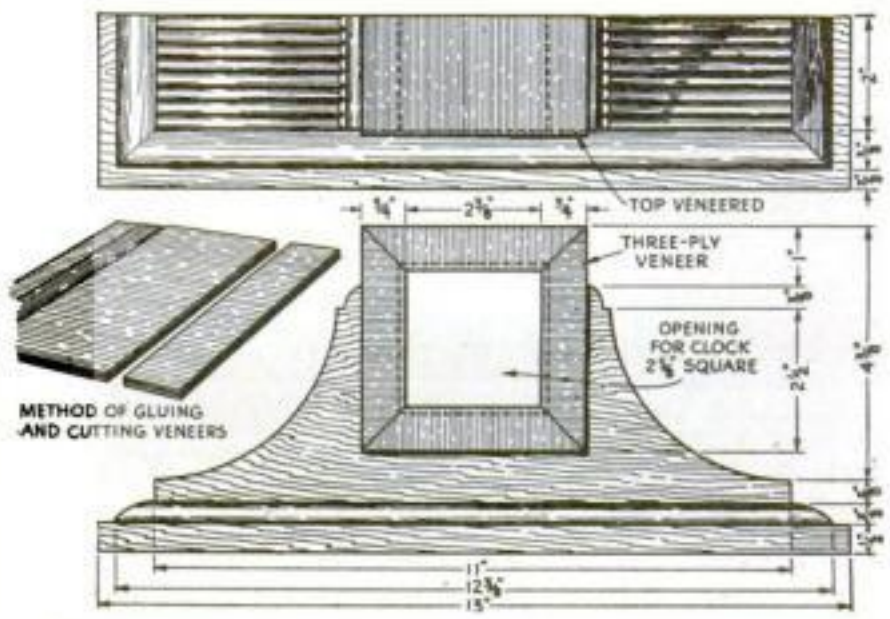
The face of the clock case is decorated with a frame made of three-ply veneer, which also forms a rabbet for the clock. Three small pieces of veneer are glued as shown, with the grain of the middle piece running at right angles to that of the other two. The veneer is glued up between two boards, which are clamped together with hand screws or C-clamps. Use casein glue and place paper between the veneer and the boards to prevent them from sticking together. Any kind of veneer may be used, but the upper piece should preferably be striped as shown. When dry, four strips are cut off and mitered as in an ordinary picture frame. The veneer may be cut with a dovetail saw, a fine back saw, or a sharp knife.

The reeds are cut with a scratch stock (tool lying on bench) and smoothed with sandpaper

The four pieces are then fitted and glued to the case. Fasten each with two fine brads and cut them off so that they project ⅛ in. Place a piece of paper on the veneer and then a piece of soft wood. Clamp together with hand screws or C-clamps. When dry, pull out the brads. Then veneer the top and the straight part of the sides in the same manner.

For a round clock the veneer is glued up in the same way and sawed to shape with a coping saw. In this case the face veneer should preferably be of a curly or wavy figure.

The base consists of two pieces ⅜ and ½ in. thick respectively.

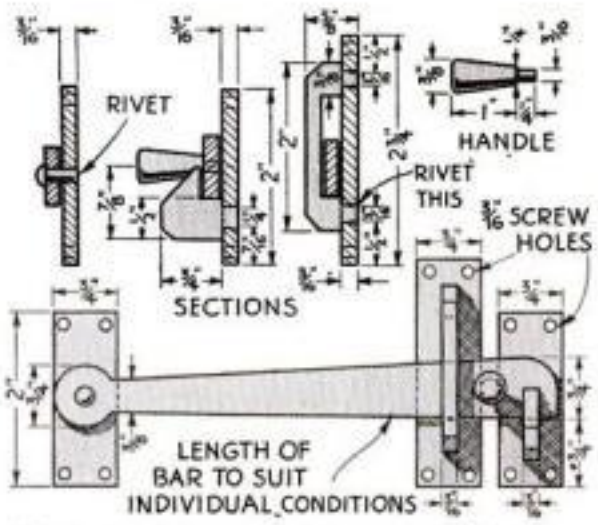


Front and top views of the clock case and how veneer is prepared. The dimensions may be adapted to suit a small clock of any variety

The edge of the 3/8-in. piece is shaped as shown. This may be done on a shaper or with an ordinary jack plane. Cut a piece about 2¾ in. wide and 17 in. long, and plane one edge, using a template to get a uniform shape throughout. Then cut the front and sides to length and miter them. In this way end grain is avoided. Glue these pieces to the ½-in. board and fasten the assembled base to the block with screws.

The clock case may be stained or left in the natural colors of the wood and the veneer. It may then be given a coat of thin shellac, which, when dry, is smoothed with No. 2/0 steel wool. This may be followed with two coats of clear lacquer. Use a soft brush and apply the lacquer as it comes from the can. Fill the brush well and flow the lacquer on. Do not attempt to brush it out evenly because it dries very quickly. Rub down the last coat with No. 6/0 waterproof sandpaper and paraffin oil. Finish with a good furniture or automobile polishing cream.

MAKING AN IRON LATCH FOR A GARDEN GATE



Neat, simple type of latch, made mainly from band iron, for use on a decorative garden gate

NOW that the winter is over, it is time to repair the fences, trellises, and arbors around the house or garden. If a new latch is needed on a gate, here is one that is substantial, yet easy to make. It consists of an iron bar and three plates. Two of the plates are fastened to the gate with screws, and the third plate to the post. The length of the bar will depend on individual conditions, but is usually about 6 in.

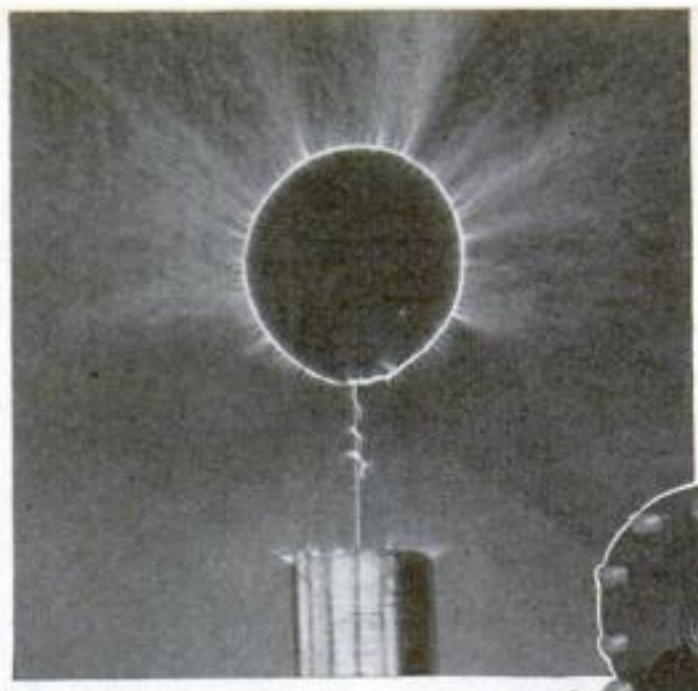
All these parts are made from a piece of band iron 16 in. long, ¾ in. wide, and 3/16 in. thick. Saw the bar and the three plates to length, and shape the bar as shown. This may be done with a hack saw and file, or on a shaper, if available. The slotted pieces riveted to two of the plates are then sawed and filed to shape, and corresponding holes drilled in the plates. These holes are all countersunk on the reverse side and the pieces riveted securely in place. The bar will slide up over the piece riveted to the plate on the post and drop into the slot, thus automatically securing the gate. Drill holes for the screws in all three plates.

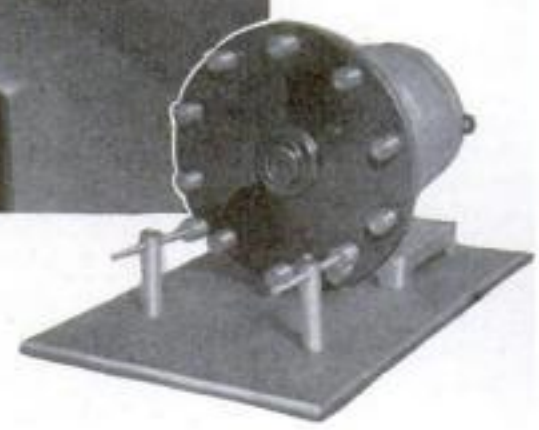
A handle may be turned and riveted to the bar. This is then slipped through the slot in the middle plate and riveted to the flat end plate so that it can move freely.

The latch must be painted to prevent the iron from rusting. Give it first a coat of red lead, and then one or two coats of black paint.—H. H.

CLEANING LACQUER FROM JARS

WHEN lacquer is used in a spray gun, an inexpensive way to clean the jars is to rinse them immediately with a little denatured alcohol. This will coagulate the lacquer so that it can be wiped out quickly in the form of shreds and scales. The method is not suitable for lacquer brushes because of the difficulty of getting the shreds out of the bristles.





Left: The completed high-frequency coil. *Above:* Weird halo effect. *Right:* The rotary spark gap

By KENDALL FORD

Juggling Thunderbolts

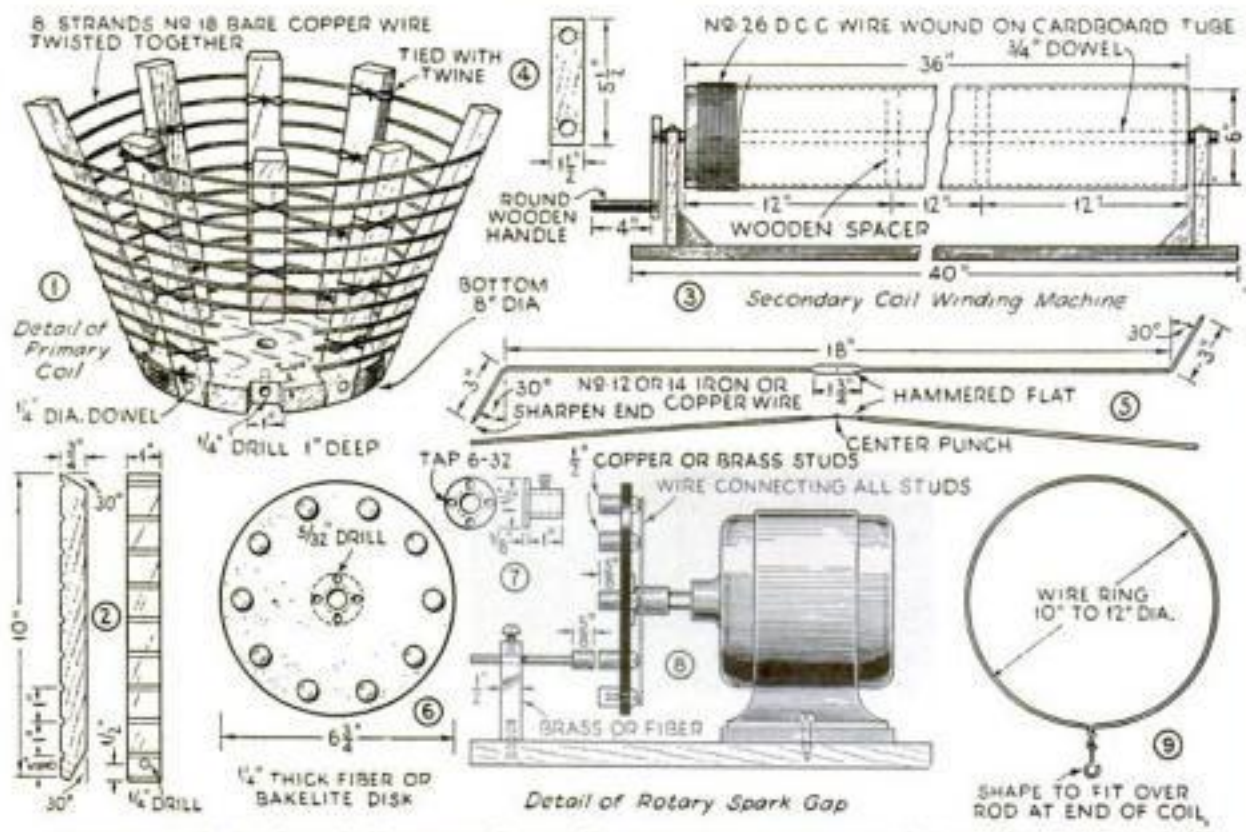
WITH HUGE HOME-MADE SPARK COIL

THIS *is the third in a series of articles on constructing high-frequency apparatus. The first (P.S.M., Dec. '34, p. 65) told how to make a Tesla coil operated by a commercial high-voltage transformer. The second (Feb. '35, p. 86) described an inexpensive outfit in which an automobile spark coil was used. The present article is on making a giant coil. An article on how to build a 12,000-volt transformer suitable for energizing it will follow in an early issue.*

• • •

READERS who have once discovered the fascination of experimenting with high-frequency electrical apparatus will rarely be content until they have built a large coil such as the one illustrated. This is capable of sending out crackling 36-in. steamers and opens up a field of experiments not possible with a smaller coil.

Primary Coil. Cut 8-in. circle from ¾-in. board. Notch it at eight equidistant points, Fig. 1. Drill ¼-in. holes 1 in. deep in each notched section. Make primary coil support from eight strips of wood ¾ by 1 by 10 in., Fig. 2. Determine size of wood rod to be used through center of secondary coil form, and drill hole of corresponding size through the center of base, Fig. 1. Then assemble primary coil form. Secure slanting supports to base with ¼-in. wood dowels and glue. Prepare cable for primary winding by twisting eight pieces of No. 18 bare copper wire together. (Secure the pieces in a vise and place the opposite ends in the chuck of a hand drill for twisting.) Fasten one end of cable to base with small staple and wind ten turns on form without too much tension. Keep turns in place by tying to supports at several places with twine. Do not use



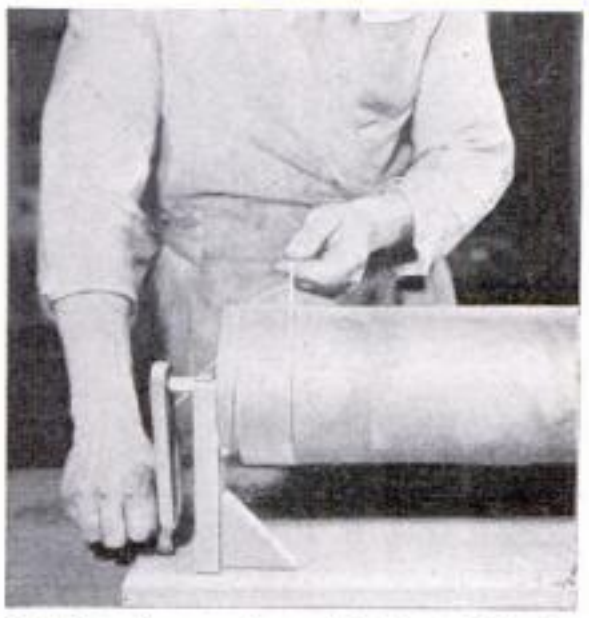
Primary coil; jig for winding secondary coil; rotary spark gap; revolving wire, and wire ring

nails or screws, which would cause sparking sufficient to char the wood.

Secondary Coil. For form use heavy cardboard tube from 6 to 8 in. in diameter and 36 in. long. Floor-linoleum tubes are often of just the right size, but if not obtainable, make a tube of these dimensions by the method previously described (P.S.M., Feb. '35, p. 86). Cut four 6-in. circles of wood, drill holes through centers, and place them 12 in. apart along a ¾-in. dowel rod or old broom handle. Allow rod to extend several inches beyond ends of form so form may be placed in winding jig. Wrap several layers of cardboard around the wood form and glue layers together. Shellac tube and allow to dry. Details of a temporary winding jig are shown in Fig. 3 and 4. Beginning at one end, wind a layer (about 2 lb.) of No. 26 D.C.C. wire closely and evenly to within ¼ in. of the opposite end. Shellac coil. When dry, secure to base of primary coil by fitting the extended rod into hole in primary coil base. Mount brass rod, 8 in. long and with the upper end filed or turned to a sharp point, on top of coil. Connect upper end of secondary winding to it. Connect lower end of secondary coil to lower end of primary coil.

Condenser. Follow method outlined in the February article, but make condenser in two sections, each containing fourteen sheets of clear glass, 8 by 10 in., and thirteen sheets of metal foil 6½ by 8½ in., with a connecting tab 1 in. wide. Because tin and lead foil tear easily, copper or brass foil is to be preferred. However, if connecting tabs on outside sheets of tin foil are reënforced with thin copper or brass, it may be made to serve satisfactorily. Corners of metal foil should be rounded slightly to avoid any possible corona losses at those points. There should be a ¾-in. margin all around foil, except at the connecting tab. While assembling condenser, shellac or varnish may be used as an adhesive, although it is difficult to dry either completely after the foil is in place. If plates are warmed in an oven and then rubbed with lump of beeswax, the foil may be laid into place securely. After beeswax has been applied, set metal foil in place immediately and smooth down with folded cloth. When condenser is completely assembled, bind with cotton tape. To reduce losses and avoid possibility of its breaking down, the condenser should be immersed in a wood or metal box filled with transformer oil or paraffin oil. The oil would soon weaken rubber on friction tape if used, and allow condenser to fall apart. The two sections of condenser are connected in parallel, then connected in circuit as one unit.

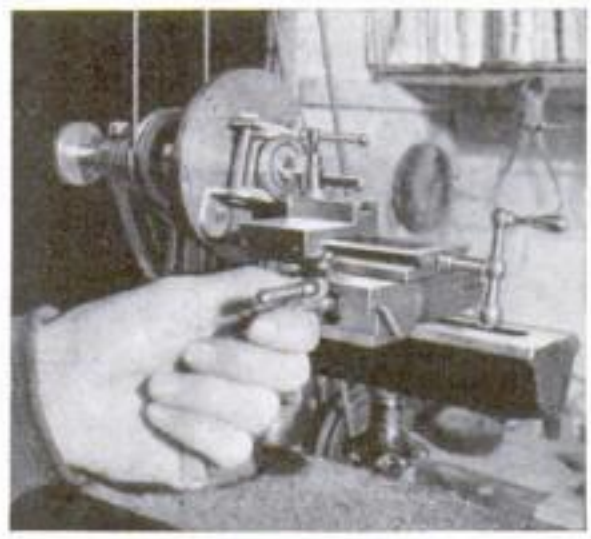
Alternative Condenser. A rather bulky and much less efficient condenser may be made by immersing quart bottles or jars, half filled with salt water, in a metal pan filled with salt water to a height of that in the jars or bottles. Strips of *(Continued on page 105)*



Winding the secondary coil by hand with the aid of the jig shown in the working drawings

SIMPLIFIED MODEL STEAM ENGINE

(Continued from page 72)



Turning recess in disk at rear of cylinder

lathe, or core prints may be put on the pattern and the casting made with a ⅜-in. core.

Having obtained your castings, proceed as follows:

Cylinder. Mount in four-jaw chuck or on angle plate bolted to faceplate as shown so that center line of cylinder bore is in line with lathe centers. Face off one end of cylinder. The casting may then be turned end for end. If the finished end is butted against face of chuck, the opposite end will be parallel and can be faced off.

To finish surface of disk that forms back of cylinder assembly, the casting may be mounted in the four-jaw chuck or on an angle plate fastened to the faceplate. The second method is preferable. If the angle plate is used, placing one finished end of cylinder on it will insure that cylinder is at right angles to lathe bed. It is then necessary only to adjust the casting until surface of disk to be finished is at right angles to a line between lathe centers. This can be done by mounting a scriber in tool post.

After surface of disk has been finished flat, take a 1/32-in. cut across the center, leaving a 3/16-in. rim at edge to reduce bearing.

To bore cylinder, mount it on an angle plate with one finished end flat against the surface of faceplate. Adjust until a line between lathe centers coincides with center line of cylinder bore. With boring tool, bore cylinder to finished size. The last cut should be fine, with a slow feed. The cylinder will be lapped in after piston has been made.

Drill steam ports as shown. Holes for cylinder-head bolts may be drilled and tapped to suit your convenience. The writer used a 1/16-in. tap and made small screws to fit. Cylinder heads may be of ⅛-in. sheet brass.

For the stuffing box, thread a piece of brass rod ¼ in. in diameter. Turn it into a threaded hole in center of lower cylinder head and cut off to required length. Then drill a ⅛-in. hole through center for piston rod. This hole should be drilled a trifle undersize and finished with a ⅛-in. straight reamer. The stuffing-box cap can be made from a piece of ½-in. round brass stock.

Base and Frame. File bottom of base flat. Mount on faceplate. Block up until circular portion at top, against which cylinder oscillates, is at right angles to lathe bed with its center coinciding with a line between lathe centers. Turn this face flat, then recess the center portion like disk at back of cylinder. While casting is still in position, drill a ⅛-in. hole through center of this circular portion for bearing bolt that supports cylinder.

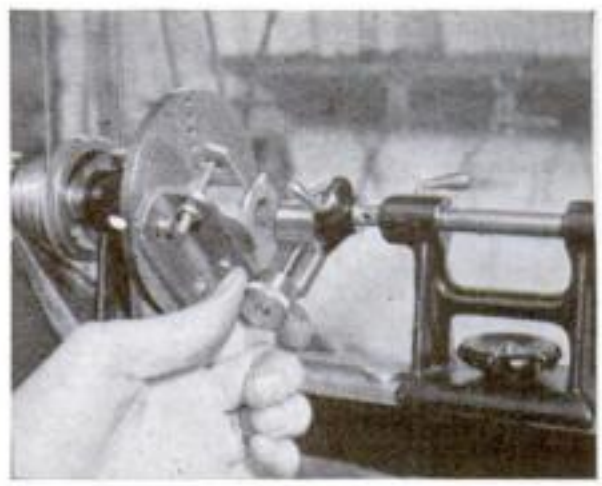
By turning lathe at slow speed and taking light cuts, the front end of shaft bearing can be faced off at this time. Change position of casting so that shaft bearing is in line with the lathe centers. Using a surface gage resting on lathe bed, adjust so that the disk surface just finished is at right angles to line between lathe centers. Using chuck in tailstock, drill and ream shaft bearing with a ⅛-in. hole. Reverse casting and square off other end of shaft bearing. Drill steam ports with hand drill or drill press. (The photos show a rectangular piece at top originally intended for attaching an exhaust stack, but found unnecessary and therefore omitted from the drawings.)

Piston. Turn from steel rod. The shaft is ⅛-in. drill rod or cold-rolled steel, threaded at one end and screwed into a hole tapped in center of piston. If cylinder is carefully bored and piston is lapped in, no piston ring is necessary. The groove in piston will hold oil and prevent undue leakage. If desired, however, a split ring can be made.

Crankshaft. Build up from ⅛-in. cold-rolled steel.

Assembly. The cylinder is held against engine frame by a ⅛-in. bearing stud, screwed into a hole tapped in rear of cylinder. A coil spring holds cylinder against frame. The tension should insure a close fit, but should not interfere with free oscillation of the cylinder. Cylinder and engine-frame surfaces should be lapped together with fine valve-grinding compound. The piston should also be carefully lapped into the cylinder. The flywheel is turned from brass and keyed to shaft, or may be a driving fit.

Alternative Construction. By making a few changes in design, it is possible to construct an engine of this type without a lathe. The



Boring cylinder with small boring attachment

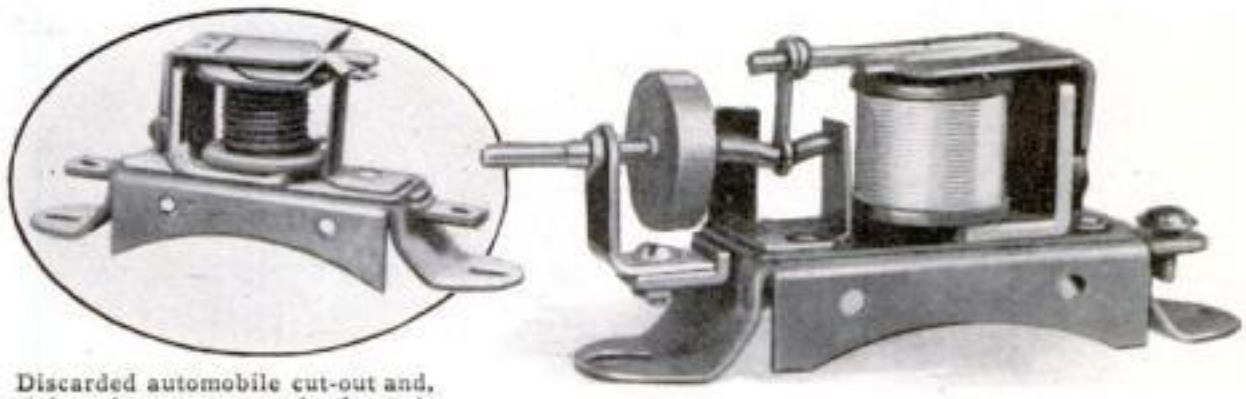
cylinder may be made from a piece of heavy brass tubing or from a brass bushing of suitable size and bore. A disk of heavy brass can be sweated to one side and filed flat. Then the surface should be scraped down so that only a small area around the steam ports is in contact with the bearing surface of the engine frame. Other surfaces can be filed smooth. In finishing the engine frame, file the surface against which the cylinder oscillates as flat as possible; then scrape down all but a small area around the steam ports.

If brazing equipment is available, no castings need be made. The engine frame can be of heavy sheet brass sweated together.

Action. Steam is led to engine through brass tubing which enters both inlet ports, one at top, the other at bottom. Check ports so that connection is made with proper holes. When piston is at top, the port in cylinder should be in line with inlet port in engine frame. The lower inlet port in frame will then be covered by the cylinder, while the hole in lower end of cylinder will be in line with lower exhaust port in frame. When piston is driven downward, steam is driven out of lower exhaust port.

In an article scheduled for early publication, Mr. Fankhauser will tell how to make a boiler suitable for use with this engine.

Small Electric Motor Constructed from Old Auto Cut-Out



Discarded automobile cut-out and, right, tiny motor made from it

VERY small electric motors for experimental purposes or use in models can be made from discarded automobile generator cut-outs. They cost only about seven cents apiece—for wire and solder, provided you can get the cut-outs for nothing. Any make or style can be used, but it is easier to work with them if the coil is bolted to the base rather than riveted and if one or both of the point supports can be used for bearings. The inside bearing of the motor illustrated was originally the point support.

Coil. Remove armature and take coil from base. Remove both windings. Rewind evenly with about 300 turns of No. 24 magnet wire. Cut the point supports to size for bearings if you can use them; otherwise cut them clear off.

Armature. Remove everything but the hinge spring from armature and cut it off even with edge of coil. Flatten one end of a ⅛-in. steel rod and solder on top to take connecting rod. The length of this piece is determined by the most convenient place for the crankshaft dip.

Crankshaft. Use same size rod and bend evenly. A dip of about 3/32 in. giving a 3/16-in. stroke, is best. Make half a dozen, if necessary, and select the best.

Bearings. If you can't use point supports, make them of light sheet metal. The design will vary with the type of cut-out. On most cut-outs, at least one bearing can be used.

Flywheel. Punch from 3/16-in. sheet lead and solder on crankshaft. This is easier and quicker than casting, but if no sheet lead is at hand, cast it on crankshaft. The best diameter for most cut-outs is ¾ in.

Connecting rod. This also serves as the timer and is made L shaped. No specific size can be given, but the shape can be seen in photograph of disassembled motor.

The motor disassembled, showing the few and simple parts

Brush. This must intercept connecting-rod point just as crankshaft leaves dead center on power stroke; and the connection must break before stroke is completed, but not too soon. Find correct adjustment by experiment. Use thinnest spring steel obtainable or find a section of very small clock spring with a curve corresponding as closely as possible with curve of timer point and cut it from spring with enough extra to fasten to a support. This brush must be entirely insulated from crankshaft and magnet core. Hold it with pliers and heat the entire lower or supporting part—not the curved contact part—until it glows red. Let it cool slowly. It will then be pliable enough to be adjusted to suit the timer.

Collars may be needed to keep connecting rod and crankshaft in place.

Wiring. Connect one end of coil with either main bearing, and the other to one side of current source. The other line goes to the brush.—MARWOOD GARDNER.

SPECIAL

Drill-Press Tools

SPEED UP DIFFICULT WORK

By E. A. Bower

The speed with which work can be turned out on the drill press may be increased with a few homemade attachments and some special tools

WHEN dado cuts are made on the saw, much careful hand sanding is usually required for a perfect job; yet the drill-press attachment shown in Fig. 1 does the work in a minute. It is a piece of dowel glued in a hole in the middle of a wooden disk of the required thickness and diameter, and covered with sandpaper. Another useful sander can be made by cutting out a wood cone on the scroll saw (Fig. 2). Glued to a short piece of dowel and covered with sandpaper, it gets into the corners and angles of inside work as shown in Fig. 3. Wind the shank where it is to enter the chuck with soft copper wire, as in Fig. 4.

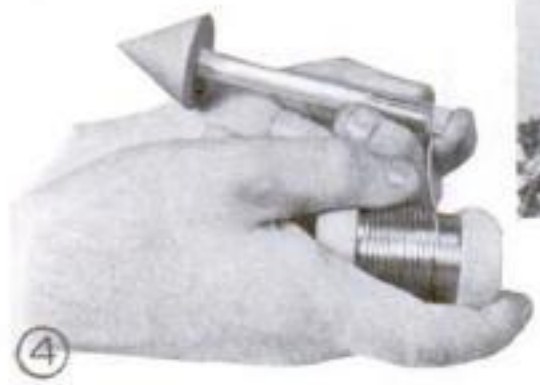
If you wish to drill very small holes in wood or light metal, a needle may be used; it leaves a very clean hole. It may also be used to do very fine routing work on projects having much detail if the head is broken off and it is filed down as shown in the drawing. Smooth it off with an oilstone very carefully.

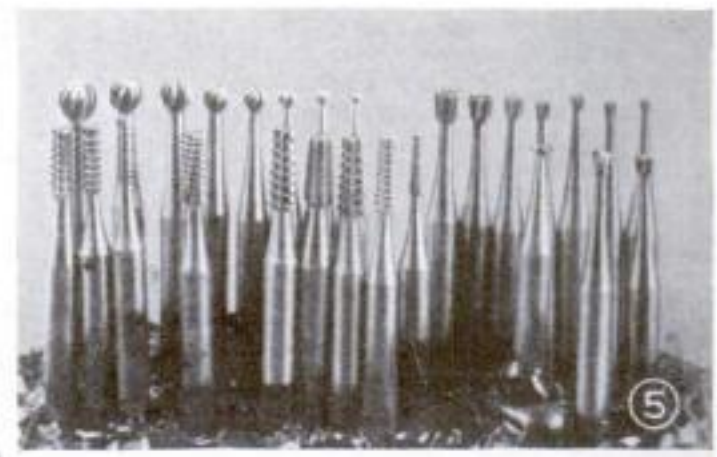
Dental drills (burs) are very small and can be held in the chuck of the drill press for a number of uses. An idea of the very many styles available is given in Fig. 5. Each design is made in a variety of sizes.

How to smooth a dado or a square-cornered groove with a special wooden sanding disk

Another type of sanding attachment which is made cone-shaped in order to reach into the sharp corners and angles of inside work

Very fine routing may be done with a needle ground as shown in the drawing. The photo illustrates how to cut out the cone used in constructing the sanding device shown in Fig. 3. *Below:* Winding wooden shank of the attachment with copper wire





A few of the many sizes and varieties of dentist's burs. These are excellent tools for delicate carving, routing, and other work on models and small novelties. Ask your dentist if he will let you have some of his old burs

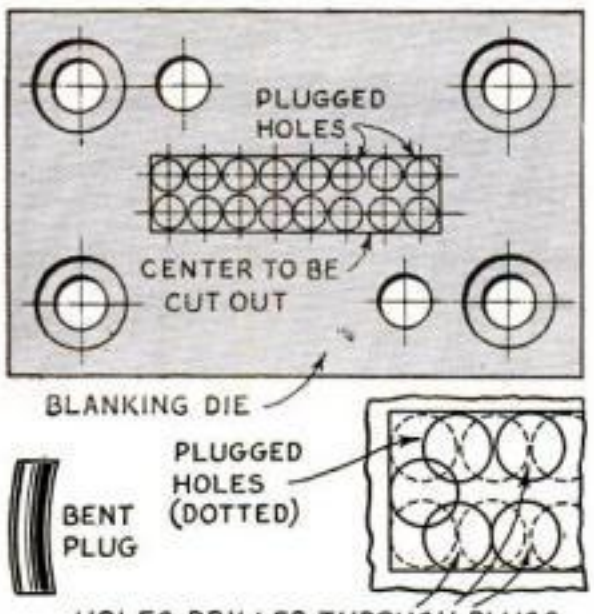
SOLUTION REMOVES ALL RUST FROM TOOLS

Removing rust from long steel scale by immersing it in a solution of ammonium citrate

BY USING a solution of ammonium citrate, rust may be completely removed from tools. If the solution is used warm, then one or two hours will suffice, but if used cold, it is best to allow the tools to remain in the liquid overnight. A tablespoonful of the ammonium citrate crystals may be used to a pint of water, although the proportions are not important. The solution will serve repeatedly until depleted.

For tools of awkward shape such as try-squares and large steel squares, a cardboard mailing container may be used in place of a vat, crock, or other container, if it is first impregnated with hot paraffin wax.—R. W.

REMOVING WASTE STOCK FROM DIE CENTER



Method of plugging holes, when drilling out a die center, with very slightly bent plugs

WHEN cutting out a blanking-die center, a better method than broaching or chipping between the holes with a chisel is to plug the holes and drill out the stock between the rows or circles of plugged holes. Sometimes in small shops, especially job shops, a complete line of drills is not carried and the only drill available for this purpose may be full size, and the pins are likely to be a loose fit. In this, case cut off cold-rolled steel pins to length, insert them in the vise, and bend slightly. The pins will then fit the holes tight enough for drilling. The same method is also useful for repairing jigs and fixtures when the original pins have worked loose.—ROBERT WELLER.

Freezing Compartment

IMPROVES ICE REFRIGERATOR

By A. L. Munson

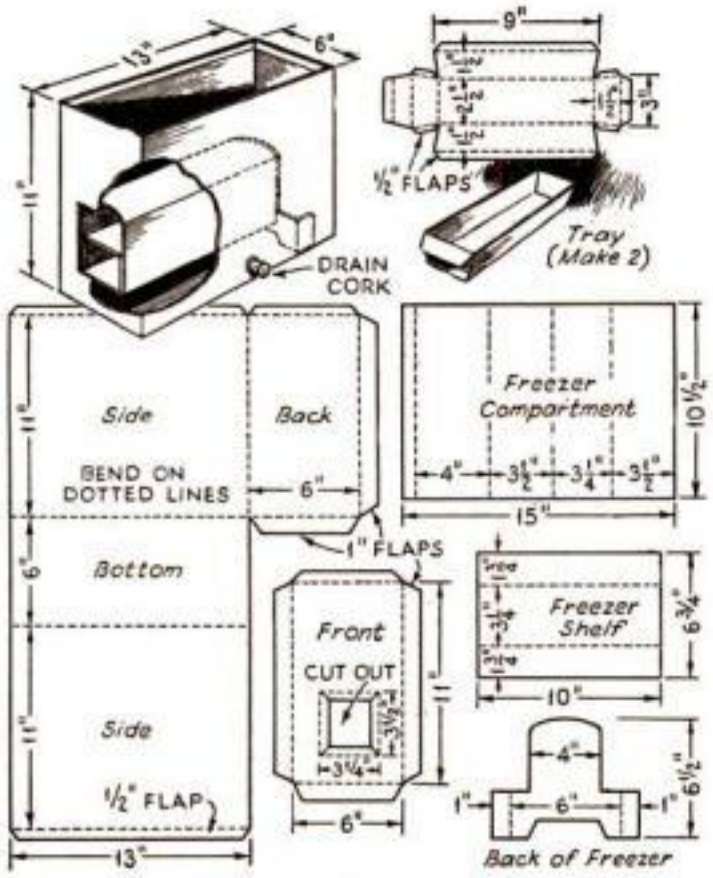
Ice cream and frozen desserts can be prepared easily in the freezer, which is packed with chopped ice and salt

A FREEZING compartment with trays may be added to an ordinary ice refrigerator, thus giving it one of the advantages of an electric refrigerator. With its aid all sorts of new desserts may be prepared. The principle is the same as in the old-fashioned ice cream freezer using chopped ice and salt.

The compartment is shaped like that used in electric refrigerators, with one or two trays for ice cream and frozen custards. The middle shelf is removable, which is an added advantage. If, for example, someone brings ice cream home several hours before it is to be used, it can be kept cold and hard in this freezer. Sherbets and similar desserts can be frozen, too.

The dimensions are only to give an idea of proportions because you will have to fit the compartment to your own ice box. And if ready-made refrigerator trays are available, the freezer can be made to suit. Allow plenty of room to put ice and salt into the freezer, so you won't have to remove the freezer for every icing. One side may be cut down a little, if desired, to make room for adding ice. If you have a "side icer" refrigerator, you can swing the freezer under the top of the ice compartment and use the trays side by side instead of as shown.

The tray compartment must be made watertight to keep brine from working its way into the trays. For best results, some sort of sliding door or flap should be used over the tray compartment opening so no warm air will penetrate into the space surrounding the trays. Quicker freezing also will result if the trays are pushed as far into the freezer as possible.



The freezer compartment and back are first assembled and soldered to the front; then the outer case is added

A piece of sheet metal (light for easy handling) about 3 by 4½ ft. should be large enough for all the necessary elements, including trays, provided you lay out the parts in the most economical way. Or, if you prefer to use tin, two ordinary sheets of tin should be sufficient. Assemble the tray or freezer compartment first; then solder it to the front of the large outer case before soldering this front part to the rest of the assembly. Care should be taken to protect the metal with a suitable paint. A plain cork can be used for the drain opening.

Use plenty of rock salt for best results, and you will be delighted with the way the freezer frosts over and freezes desserts.

THREADS POLISHED WITH WIRE BRUSH WHEEL

THREADS that have been cut on a lathe or with a die can be polished quickly with a coarse wire brush wheel used on a grinder. This removes all sharp edges and gives a good finish.—M.A.C.

GUILD EXHIBITION

(Continued from page 67)

Dunkirk, N. Y.; Homecraft Club of Pittsburgh, Pa.; Norristown Craftsman Club, Norristown, Pa.; Sheffield Homeworkshop Club, Sheffield, Ill.; Coleman Homeworkshop Club, Coleman, Alberta, Canada; Three Rivers Homeworkshop Club, Three Rivers, P. Q., Canada; Chickasaw Homeworkshop Club, Memphis, Tenn.; Cudahy Homeworkshop Club, Cudahy, Wisc.; Waupaca Homeworkshop Club, Waupaca, Wisc.; and a new Chicago club tentatively named the Edison Homeworkshop Club to distinguish it from the Chicago Premier Club.

WHAT HOME WORKSHOP CLUBS ARE DOING

TOPEKA HOMEWORKSHOP CLUB, Topeka, Kans. The work of the boys' division, or junior auxiliary, is constantly being expanded. The boys start in the first division as apprentice craftsman and study silhouette work, bead work, leather craft, cement work, modeling and archery. They then advance to the second division, where they are known as craftsmen. This course consists of metal casting, wood carving, model aircraft, model boats, and model coach construction. The third division, in which the members will be known as master craftsmen, will take up such subjects as microscopy, radio, astronomy, chemistry, and photography. A boy must complete five subjects in one division before advancing to the next. When the master craftsman certificate has been awarded a member, he will then be entitled to study the essentials of firearms and the use of power tools. The Y. M. C. A., Optimist Club, Metro Club, and other Topeka organizations are coöperating in the work. . . . Classes are now being regularly conducted every two weeks in show-card lettering, photography, and woodworking. The show-card class under George F. Gladfelter has now been running so long that one division is about to graduate. The photographic class is taught by C. J. Boeger and Steve Smith. . . . At a recent meeting of the club George Shadwick and Richard Daniels gave demonstrations and exhibited some of their enlargements. . . . The club's "News Bulletin," which now appears as a printed leaflet, has *(Continued on page 90)*

Caricature of wrestler in myrtle wood and a candle stand carved by W. I. King of the Eugene, Ore., club

HOME WORKSHOP CLUBS

(Continued from page 89)

Toys made by the Homecraft and Modelmakers' Guild, Richmond, Va. Left to right: L. H. Perrot, L. J. M. DeJong, W. I. Stockton, Jr., F. W. Harrison. Kneeling: Floyd E. White

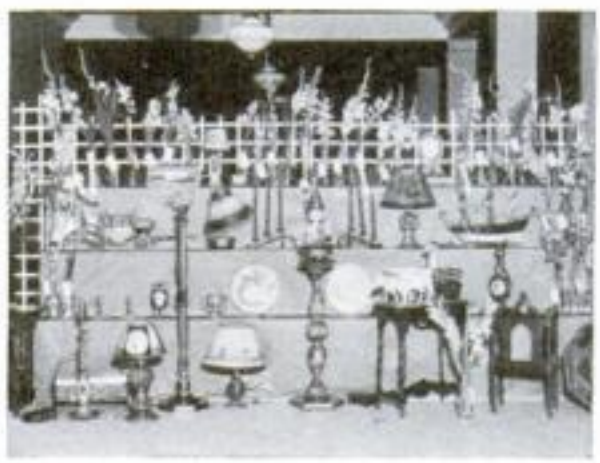
started publishing advertisements of local dealers in home workshop supplies.

Cheyenne Homeworkshop Club, Cheyenne, Wyo. A hundred pieces of craftwork, made since January 1, 1934, were displayed at the second annual exhibition, which was open to the public for six days and nights. The registration book was signed by 750 visitors. D. R. Kinports won the Popular Science Craftwork Medal for a workbench, which was the first prize winning project in the individual contest. Lief Eskesen won a year's dues in the club for a fretwork vase stand. Third prize, a year's subscription to POPULAR SCIENCE MONTHLY, was awarded to W. F. Winkle for a gun cabinet. For the best group of exhibits, Mr. Eskesen won first prize and Mr. Kinports second prize. . . . . Mrs. A. E. Roedel is the first woman to become a member of the club.

Scranton Craftsman Society, Scranton, Pa. At the first annual exhibit held in the Chamber of Commerce Auditorium, Walter Marsh won first prize; Carl Boettcher, second; and John Bobersky, third. A number of smaller prizes were given in various divisions.

Middletown Homeworkshop Club, Middletown, Conn. At a recent meeting of the club held in the Middletown Trade School, Joseph C. Toff, instructor of electrical work at that school, gave a talk on motors.

The Dalles Homeworkshop Club, The Dalles, Ore. An all-day exhibition of lathe work and joinery was given by one of the club members in a local hardware store window recently. So much interest was aroused that a policeman had to keep the sidewalk open. As one result, a large number of inquiries were received in regard to joining the club. *(Continued on page 91)*



Exhibition of Fargo (N. D.) Homecraft Guild held in conjunction with a local flower show

HOME WORKSHOP CLUBS

(Continued from page 90)

Atlanta Homecraft Club, Atlanta, Ga. Variety is given the club programs by a system of calling upon each member in turn to make a short talk on some subject in which he has specialized. The first address of this kind was given by T. P. Fiske, vice president.

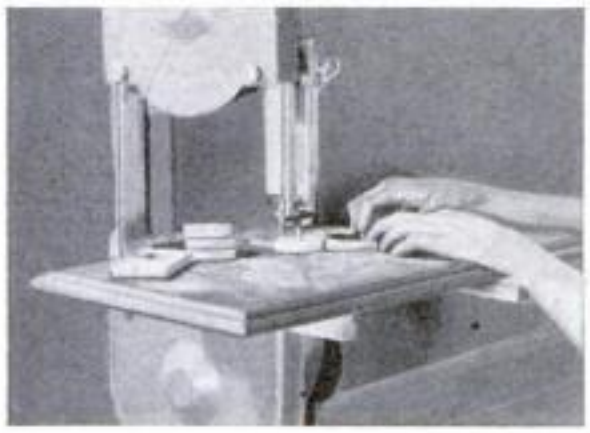
Wood-Ridge Homeworkshop Club, Wood-Ridge, N. J. Sixty projects were displayed at the club's first annual exhibition, which was open to the public for three days. Elwood K. McFarlin was awarded the Popular Science Craftwork Medal. On the basis of a popular vote by visitors, Henry G. Hoffman won first prize, which was a $10 tool order; and other prizes went to John Vierling, Fred G. Wormuth, George N. Schalk, E. Kohl, C. D. Chase, L. J. Messenger, and A. M. Romme.

Brunswick Homeworkshop Club, Brunswick, Me. A talk on practical wiring problems and an electrical movie were given at a recent meeting in the Science Building, Bowdoin College. Another meeting was held in the Portland High School.

Newcastle Homeworkshop Club, Newcastle, Calif. The annual exhibition was held for four days in Newcastle and then removed to Auburn, Calif., where it was displayed in the window of a lumber company.

Roseburg Homeworkshop Club, Roseburg, Ore. An exhibition of members' craftwork was held recently in a local hardware store.

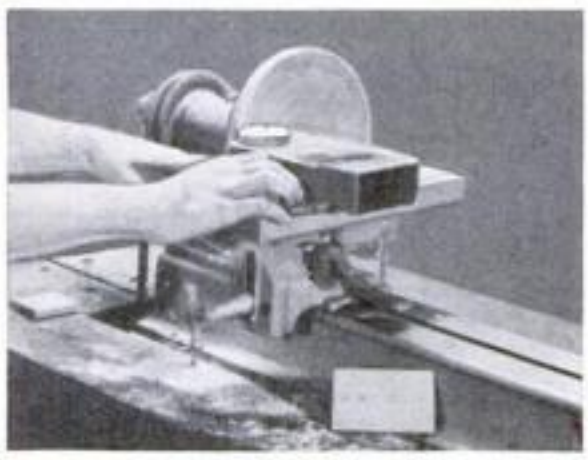
CLUB MAKES 400 TOYS BY MASS PRODUCTION



Sawing wheels on band saw with aid of jig on which the blocks revolve against the blade

WHEN the Denver Homeworkshop Club of Denver, Colo., decided to make approximately 400 toys for distribution to various orphanages, it passed beyond the problems of individual craftsmanship on single pieces into the field of quantity production. The toys consisted of animal and bird figures mounted on bases, each provided with four wheels and a string. Four hundred animals had to be sawed out, mounted on bases, and painted, and 1,600 wheels made, painted, and screwed to the bases.

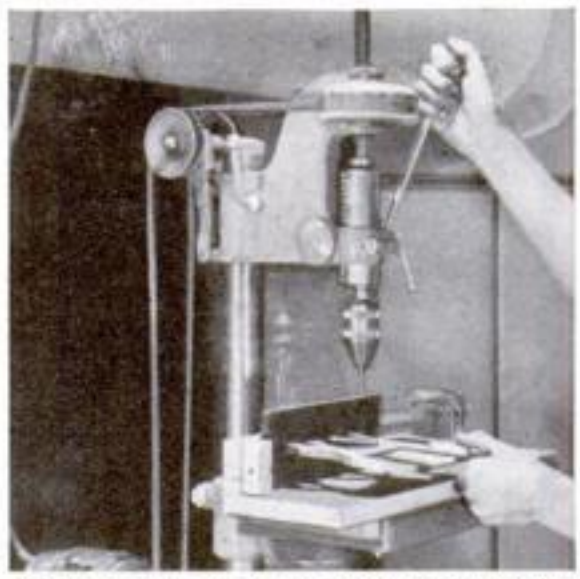
Sawing out the animal figures from plywood was largely done on jig saws, one piece at a time. Some *(Continued on page 92)*



Another pivot-type jig was used to feed the wheels against a sanding disk for finishing

CLUB MAKES 400 TOYS

(Continued from page 91)



By using this jig, four screw holes for the wheels were accurately drilled in the bases

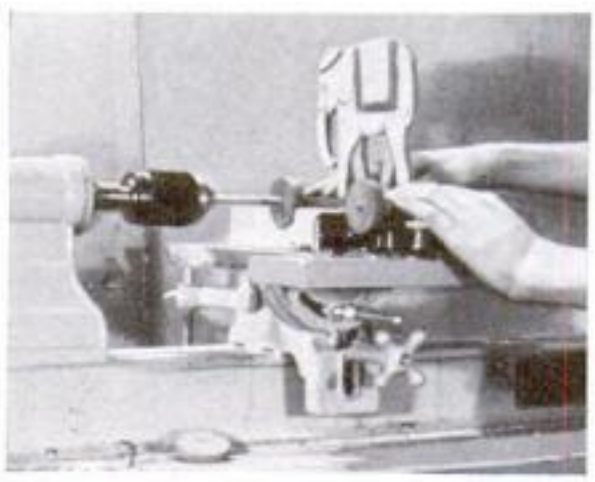
club members were able to cut as many as six at a time on the band saw. The bases were run on the circular saw, and a groove down the center cut with a dado head. Then the animals were set in the grooves and fastened with brads.

Sawing the wheels out of old box wood was done on the band saw, using a pivot jig, as shown. Of course, the wood had first to be cut up into blocks of the proper size, and the center hole drilled. This hole served both for the pivot jigs and for the axle or screw on the finished wheel. Since the band saw displayed a tendency to leave either a bump or a flat spot on each wheel, a sliding pivot jig was devised, on which the wheels were pushed across the face of a sanding disk. The wheels were spun rapidly by the revolving disk, and were turned out perfectly round at the rate of about ten a minute.

Background colors on animals, bases, and wheels were applied with spray guns. Lining and decorating the animals was hand work.

A drill press equipped with a jig as shown made child's play of drilling four holes in each base for mounting the wheels.

It seemed at first that screwing the wheels to the bases was outside of the realm of home workshop tools, but the centering jig illustrated, together with a screw-driver bit mounted in the lathe chuck, turned the trick. It was necessary to slow the lathe down to a very low speed, but this also enabled stopping it momentarily by slipping the belt, without shutting off the motor. A few turns of friction tape around the countershaft, with the belt running from this shaft to the largest pulley on the lathe head, proved the right combination. Sufficient power was provided to drive the screws home, yet the screw driver could be stopped instantly by pressure of the bare hand on the lathe pulley.—Leonard Stebbins, secretary of the Denver Homework-shop Club.



The set-up for driving the screws with which the wheels were fastened to the wooden bases

PHOTOGRAPHIC RECORD KEPT BY GUILD CLUB

ALL activities of the St. Joseph Homeworkshop Club of St. Joseph, Mo., are photographed so that a complete pictorial record may be kept to supplement the secretary's minutes. Views are taken of important projects made by members, of well-equipped home workshops, and of the various demonstrations and special features presented at club meetings. These pictures are made by Harold Gilmer, one of the members.

The collection of photographs proved valuable recently in illustrating a full-page Sunday feature article about the club in the "St. Joseph Gazette."

Other clubs can profitably follow the example of the St. Joseph organization. Good photographs will be a graphic reminder in the years to come.

Although it may not be generally known among the National Homeworkshop Guild clubs, LeVern T. Ryder, president of the Guild, has won world-wide recognition as a photographer. He has just been awarded a fellowship in the Royal Society for the Encouragement of Arts, Manufactures, and Commerce of Great Britain for "outstanding work in photographic research."

Edison Homeworkshop Club, Chicago, Ill. This name was tentatively adopted because the charter members are all employees of the Commonwealth Edison Co. Membership is open to anyone, however, and the question of a permanent name will be decided later.

Yakima Homecraft Club, Yakima, Wash. The annual exhibition and contest was held in the spacious display room of the new Pacific Power and Light Co. building. A large variety of craftwork made by members of the club and also by many nonmembers was on exhibition for four days. The work of a number of schoolboys and girls was included.

Homecraft and Modelmakers' Guild, Richmond, Va. The annual exhibition and contest was held in the gallery of the Richmond Academy of Arts.

The Homeworkshop Club of Cleveland. Furnishings are rapidly being provided for the permanent clubroom. At a recent meeting the following were presented to the club: one large table for displays, bulletin boards, ash trays, and specially prepared samples of wood joints, hardwoods, and three-ply stock.

Tucson Homeworkshop Club, Tucson, Ariz. The club's semiannual exhibition was given in the window of a large department store in the heart of Tucson and attracted much attention.

The New Egypt Homeworkshop Club, New Egypt, N. J. The members have already started to make toys and repair old toys for distribution next Christmas. They also are coöperating with the local parent-teacher association in building a large portable bulletin board for the school.

If there is no home workshop club in your community and you wish to know the advantages of starting one with the aid of the Guild, fill out the coupon below.

National Homeworkshop Guild
c/o Popular Science Monthly
353 Fourth Avenue, New York, N. Y.

I am interested in the home workshop club idea and wish to know what the National Homeworkshop Guild will do for me. Please send me this information in the large self-addressed and stamped envelope I am inclosing.

Name .....

Address .....

City ..... State .....

(Please print very clearly)

Mechanical Stage

for

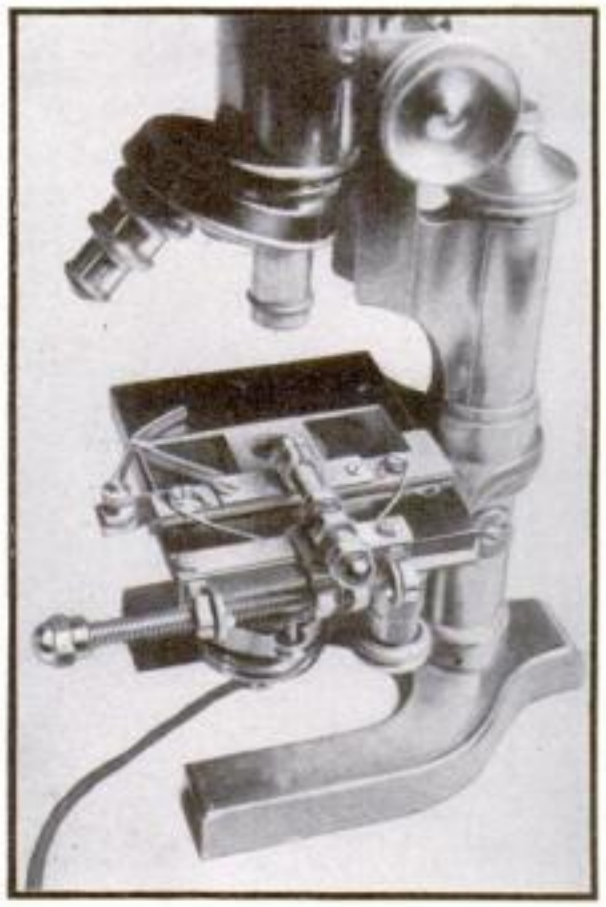
MICROSCOPE

Has four-way movement

BY OSCAR FREEMAN

A MECHANICAL stage is a useful accessory to move slides very slowly across a microscope stage and to enable the worker to examine his slides in a systematic manner. Microscopists will recognize the advantage of this simple device when they wish to refer to a certain part of a slide at various intervals. If a scale is etched on top of the stage, the stage can be reset by this for any future reference to a particular spot on the slide.

The mechanical principle used to obtain the four-way movement is not complicated, yet it gives smooth movement in four directions.

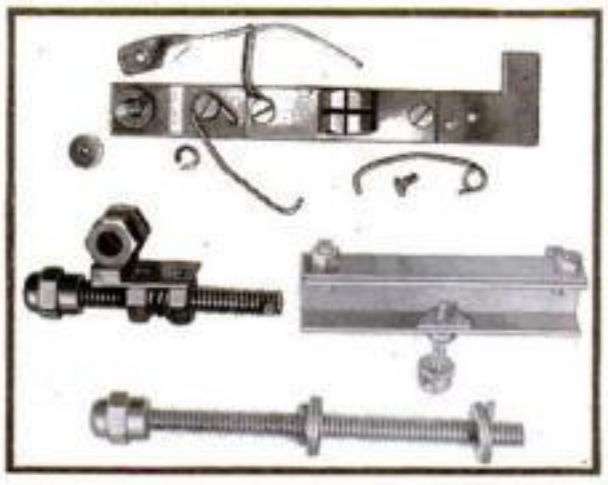


Stage in place on microscope for moving slide in systematic manner

The accessory is constructed of standard brass stock, machine screws, and nuts. Brass is suggested because of the ease with which it can be drilled and cut, and the additional advantage that it makes a good-looking job. The end nuts on the slide holder supporting the long propelling machine screws have the threads drilled out to act as bearings. Note that these nuts were sawed open in order that they might be clamped tightly around the machine screws to make the bearings free from play. Springs were put between the two sets of nuts on the moving platform to take up play, there being just enough force exerted to press the nuts apart. If screws with forty or more threads to the inch are used, the springs will not be necessary. Two safety pins were used as springs to make the slide holder more rigid. It will be noted that these springs fit between two guide pieces of thin brass, one being on each side of the channel and overlapping it slightly. All the nuts were drilled and tapped, and fastened in place with No. 4-36 machine screws, which were cut off flush with the nuts. All parts must fit closely, but not too tightly. It is important to avoid any unnecessary backlash.

The attachment alone. Dimensions are given in the list of materials

When all the brass parts are cut, drilled, tapped, and ready for final assembly, it is suggested that they be cleaned with emery and polishing cloth. Another refinement is to scribe a scale of numbers on a convenient place on the instrument to enable the worker to make a record of various sections of the slide for future reference.



Parts ready for assembly. The ends of the two bent springs work in a groove formed by slightly projecting strips of brass clamped above and below the top part of the channel

List of Materials

1—¼-in. running thread (or machine screw) 4 in. long and 1—3-in. long. (Use 40 threads to the inch if obtainable.)
10—¼-in. nuts.
2—¼-in. washers (brass and felt combination).
2—¼-in. compression springs, ½ in. long (if necessary).
2 safety pins.
12—No. 4-36 machine screws, ½ in. long.
1 piece of channel brass No. 18 (or bend stock to fit), 3 in. long.
2 pieces of strip brass 3 in. long, for guides for safety-pin springs.
1 piece of thin brass for the spring slide clip.
2 end nuts (acorn nuts).
1 piece of brass, 6 in. long, for slide holder.

Tools required: small vise, hack saw with fine blade, small hand drill, No. 4-36 tap and drill, drill for making hole through which No. 4-36 screws will slip, ¼-in. drill for drilling threads out of bearing nuts, small file, center punch, and screw driver.

CLEANING CAMERA LENS

(Continued from page 68)

ble except where it sparkingly reflects stray beams of light.

Internal fogging is another rather mysterious trouble that sometimes affects lenses. By internal I mean surfaces of the lens that are protected from the outside air. This fogging is a sort of scum, resembling "traffic film," that forms on the surfaces of the lens elements nearest the diaphragm and often on the inner surfaces of the separate sections that make up an element of the uncemented type. This type of fogging seems as likely to occur in a lens that is carefully packed away as in one that is in daily use.

Like dust or scratches, it is most easily seen when the lens is held before the eye in such a way that light comes through it, but does not strike directly into the observer's eye.

A lens good as new after twenty years

Two of the most important rules in the care of a lens are first, protect it as much as possible and second, do not clean it any more often than necessary.

The lens on any type of folding camera is quite well protected when the camera is closed. Keep it closed, therefore, as much as possible. If you have occasion to leave it open for any length of time while waiting for a picture, slip a protecting cap over it. A suitable cap can be obtained at any large photo supply house, or you can make one out of heavy cardboard with a strip of velvet cemented to the inner surface of the rim.

On shipboard and at the seashore there always is salt spray in the air on windy days in addition to the salt in the form of dust that comes from dried spray. The salt spray dries on the lens surface and covers it with a multitude of tiny white spots. They do the lens no harm nor are they particularly difficult to remove, but they necessitate much more frequent cleaning.

The best solution is to have a filter over the lens all the time you have the camera open at the seashore or on shipboard. A light yellow filter will improve your pictures, and the filter will protect the lens from the salt spots. Of course, the filter will have to be cleaned frequently, but the latter is relatively inexpensive and easily replaced as compared with a fine anastigmat lens.

There is nothing difficult about cleaning a lens, and you run no risk of scratching it if you do the job properly. The way *not* to clean a lens is to pull a handkerchief out of your pocket and give the lens surface a good scrubbing. One good material to use is an old linen handkerchief that has been through the laundry so many times that it is beginning to go to pieces, but all things considered, I believe that the safest material is the special lens-cleaning tissues sold by photo supply houses and optical goods dealers. This tissue comes in books of fifty sheets for about fifteen cents.

If you want to do a really scientific job of lens cleaning, first dust off the top of the table on which you intend to work. Use a slightly damp cloth and dust the camera with it, too, especially the creases in the bellows. Do not touch the lens with the cloth, but wipe all the exposed parts of the shutter. Now wash your hands and after drying them on a clean towel, tear out a sheet of lens tissue. Fold it so that the tiny fibers at the torn end form a brush with which to dust the front and back lens surfaces as shown in one of the illustrations. If you *(Continued on page 96)*

CLEANING CAMERA LENS

(Continued from page 95)

use an old linen handkerchief, the fibers around a hole will serve the same purpose, or you can use a camel's-hair brush that is kept scrupulously clean and reserved for this work alone.

Brushing with lens tissue fibers or the alternate methods mentioned is very important. It removes the rough particles without danger of scratching the glass surface.

Examine the lens after you have brushed the front and back surfaces. If you find that the brushing has removed virtually all the dirt so that the surfaces seem clean and brilliant, stop right there. The job is finished.

If the front surface of the lens still does not seem clean, breathe on the lens surface and immediately wipe it with the folded and crumpled-up piece of lens tissue, using a circular motion as shown in another illustration. Examine the lens again and if, now that the front surface is really clean, you notice dirt on the rear surface, go after it in exactly the same way.

The chances are, cleaning the front and back of the lens will be all that is necessary. If the inner surfaces require attention, follow the same method after unscrewing the elements from the shutter. Be sure to fold the lens tissue so that a fresh portion is used on each lens surface. In cases where an oily deposit has coated the lens, it may be necessary to wipe several times, using a fresh tissue surface each time to remove all the smudge.

As this procedure indicates, an occasional dusting of the front and back surfaces, wiping at less frequent intervals, and a thorough cleaning, say once a year, will keep any lens in prime condition for a lifetime.

The lens shown in the preceding column, for example, was old when I bought it secondhand more than twenty years ago. It is in almost daily use and still is as good as the day it was made!

Winners in Final Photo Contest

THE third and last photo contest in our winter series (P.S.M., Jan. '35, p. 78) was restricted to Christmas subjects. A large variety of excellently chosen and skillfully photographed views were submitted. After a careful comparison of all the pictures, the judges have made the following awards:

FIRST PRIZE, $25

Paula K. Morse, New York, N. Y.

SECOND PRIZE, $15

Augusta Strumpen, Philadelphia, Pa.

THIRD PRIZE, $5

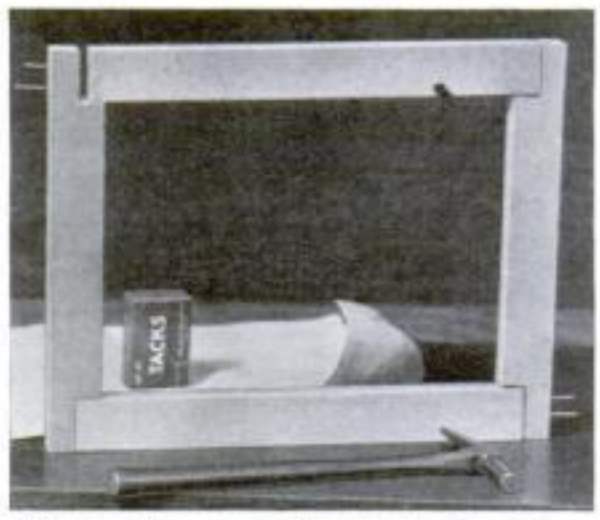
Edward Ebbert, Oak Park, Ill.

FIVE PRIZES, $1 Each

Walter Von Egidy, Stamford, Conn.; Willabel C. Mitchell, Watertown, N. Y.; H. Carl Schmidt, New Ulm, Minn.; M. E. Stocks, Toledo, Ohio; W. Edward White, Plymouth, N. H.

HONORABLE MENTION—*Billie D. Allen, Beaver Falls, Pa.; Rudolph Boger, Woodhaven, N. Y.; Ward Freeman, Detroit, Mich.; G. A. Haraden, Manchester, Mass.; Joe Hayek, Berwyn, Ill.; Harry E. Herman, Fullerton, Pa.; F. C. Hilker, San Pedro, Calif.; Charles F. Koubek, Berwyn, Ill.; J. W. Russell, Ironton, Mo.; T. R. Toolan, Rochester, N. Y.*

HOMEMADE STRETCHERS SAVE ARTIST MONEY



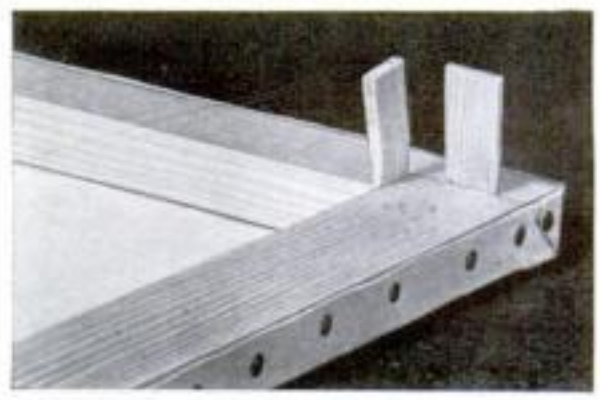
The stretchers are made of soft pine strips, half-lapped and nailed at the corner joints

ART-STORE stretchers for oil paintings are rather expensive for the artist who works more for pleasure than profit, but he can make his own by the method illustrated.

Clear white pine strips ⅞ by 1½ in. are used. Out of each end of one pair of strips, cut a piece ¾ by 1½ in. Then assemble the stretcher with two sixpenny finishing nails in each corner.

If you are using the regular prepared painter's canvas, which is the best in the long run, cut a piece of the correct size, lay it face down on the table, and sponge the back with water. Let it stand about a minute and then wipe away the surplus with an old towel.

Place the frame so that the margin is the same all the way around. In the exact center of one side, draw the canvas up against the frame and drive one 8-oz. tack. On the side directly opposite, pull the canvas tight and drive another tack. Do this with the other two sides.



If the canvas requires tightening, wedges are driven into the joints of the stretcher

Starting again on one side, draw the canvas tight and drive tacks 1 in. on each side of the center tack. Do the same on the side opposite the first, then on the other two sides. Continue this method, stretching the canvas across and toward the corners as you go. When you reach the corners, fold the canvas over smoothly and tack. By holding a razor blade flat against the back of the stretcher, trim the canvas flush.

This method provides for wedging the corners both ways to tighten the canvas whenever necessary.—CLARK H. RUTTER.

BLUE FOR METAL PARTS

AN EXCELLENT blue that closely resembles the chemical blue applied to gun barrels can be made with ordinary liquid shellac and methylene blue. The latter is an aniline dye obtainable at drug stores. Add only enough to give the shellac a light blue color, testing on a piece of metal until it is dark enough. This finish may be used on any metal surface.—R. A.

A SHELTER FOR YOUR WEATHER INSTRUMENTS

(Continued from page 63)

The shelter is placed so that the back and open door face toward the prevailing storms

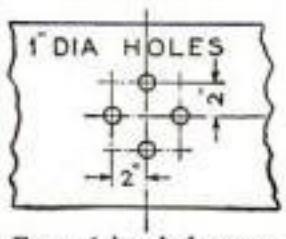
the edges with 6-penny finishing nails. Trim the ends and edges flush.

The door boards should be assembled loosely over the cleats to center them and make the edge boards of equal width. Then blind-nail them to the cleats, screw the cleats to the boards with 1¼-in. flathead screws, and cut to size. The easiest way to hang the door is to use strap hinges put on the outside, in which case bolts, with the nuts inside, should be used. Butt hinges mortised into the edges of the case side are better, and they may safely be screwed on since the screws are hidden.

The roof box or framework is 2½ ft. wide and 4 ft. long, but the front and rear pieces project so that the roof itself is 3 ft. wide. Saw the ends of the front and rear pieces at an angle, as shown in the perspective drawing of the roof box. Butt the sides between the front and back, and cut a piece of 2 by 4 in. stock to fit between the sides in front. Bevel the upper edges to fit slope of sides.

The two braces are pieces of 1 by 4 in. lumber notched at the upper ends to fit against the cleat, and mitered on the lower ends. Clamp them to the roof side boards and bore the bolt holes.

Sheath the roof lengthwise, adding edge strips as shown so that water from the roof cannot drip from the sides. A good grade of roofing paper should be used. While it is hard to get scraps of new material, good used pieces can be obtained at a wrecking yard. New or old, it should be warm when laid, or cracks are likely to result. Cut a 44-in. strip and lay crosswise of the roof with a 2-in. overhang at the back, and weight it down. Lap the other strip 2 in. over it. It is hardly necessary to cement the joint. Drive roofing nails 2 in. apart along the joint, bend the edges of the paper over the beveled edge strips, and nail into the sheathing edges. Nail the front and back edges from the centers out, cutting the corners in such a way that most of the lap will come from the top, and fill the joints with cement. Finally, trim the edges neatly.



Four 1-in. holes are bored in the top and bottom of the case, spaced as indicated

You will want your shelter foundation to last, so take some precautions against decay. Char the lower ends of the posts for a distance of 30 in., or soak them with creosote. For setting them, the best method is to dig holes about 1 ft. in diameter and cast concrete around them, but well-tamped earth will hold the treated posts rigidly for some time. Nail spacing *(Continued on page 98)*

A SHELTER FOR YOUR WEATHER INSTRUMENTS

(Continued from page 97)

strips across the posts to hold them parallel and 24 in. apart, prop them in their holes, plumb them, and fill the holes. When well set, level a line across the tops and miter them to shed the rain. Guide strips nailed on the posts will make this job easy.

Mark the post positions on the case and bore three ¼-in. holes in each side for lag screws, staggering them so that no two lie in the same grain—to prevent splitting in hard winds. Nail rest cleats on the posts as shown in the drawing, set the case on them, and mark the bolt holes on the posts. Drill guide holes ⅛ in. in diameter, replace the case, and turn in lag screws having washers under the heads.

The instrument case, combination roof and hood, and door as they look before erection

To bolt the roof on, tack spacer blocks at the top of the case, and on the lower ends of the braces. Then prop the roof in place, clamp, and bore the bolt holes. Insert the bolts and draw up. Put a turn button or a hook on one brace to hold the door open.

This completes the shelter. If you live in a locality where heavy winds are to be expected, it would be well to set the posts flush with the front edges of the case, adding a third post in the center of the back, and bracing the three together.

Choose a cool color of paint so that the inside will not become heated by absorption of sunlight.

It is impossible to give hard-and-fast rules for mounting the instruments, since there is such a wide variety of designs among commercial apparatus. The arrangement shown in one of the photographs is good. The mercury barometer is hung at the left, where it is handy to adjust; the wet-and-dry bulb thermometers are in the center, where they encounter the best circulation of air, and should be taken down and waved in the air before reading; at the top right is an electrically coupled weather vane; next below it the anemometer dial, then the maximum and minimum thermometer. There is also space for storage of accessories, for an actinometer and other instruments, and for hanging an entry pad for keeping the records.

List of Materials

1 pc. 1 by 12 in. by 10 ft., S4S, pine or fir
1 pc. 1 by 12 in. by 6 ft., " " " "
1 pc. 1 by 10 in. by 4 ft., " " " "
4 pc. 1 by 6 in. by 8 ft., " " " "
1 pc. 1 by 4 in. by 8 ft., " " " "
2 pc. 4 by 4 in. by 8 ft., " " " "
1 pc. 2 by 4 in. by 8 ft., " " " "
16 sq. ft. roofing paper with nails
20 No. 8 flathead wood screws, 1¼ in. long
1 pr. 4-in. strap hinges with 1-in. bolts to match, or 1 pr. narrow steel hinges, fast-pin, 3 in. long
4—4 by ¼ in. carriage bolts with washers and nuts
4—3½ by ¼ in. carriage bolts with washers and nuts
4—1¾ by ¼ in. carriage bolts with washers and nuts
6—3 by ¼ in. lag screws with washers
1 turn button or hook and eye
6- and 8-penny finishing nails

MICROSCOPE PICTURES IN THREE DIMENSIONS

(Continued from page 43)

dimensional effect that is so interesting.

Because you will be working at low magnifications, you will use long-focus (low-power) objectives and eyepieces. Frequently you will use the objective alone, without eyepiece. Even at these low powers, you generally will find that there is not as much depth of focus as there ought to be. Stereoscopic pictures of any type are, in the matter of sharpness, different from ordinary photographs. Everything in the picture should be in sharp focus, from the nearest to the farthest point. In the ordinary photograph, effect of depth frequently is produced by having the main object focused sharply, while the background is blurred. Incidentally, a detailed, somewhat soft print makes a better stereoscopic picture than a harsh one. Special photomicrographic plates sometimes are not as satisfactory as ordinary film, for this reason.

BUT to get back to the problem of depth of focus: It becomes desirable, then, to have the nearest and farthest parts of the microscopic object in focus at the same time, and to have the focus as sharp as possible. The sharpness can be increased by the use of color-sensitive films or plates, and light filters or screens which absorb some of the colors that normally are not focused sharply by the lens systems of the microscope.

Most microscopes perform best by yellowish-green light. By using an orthochromatic or panchromatic film or plate and a green filter, such as the Wratten B filter, or a combination, such as the Wratten G and H together, sharper pictures can be obtained. The use of filters was discussed in an earlier article of this series. (P.S.M., Nov. '33, p. 44:)

If your microscope is equipped with an iris diaphragm below the stage, the depth of focus of the lenses can be increased by reducing the size of the diaphragm opening. This reduction should not be great enough to cause distortion of the image by diffraction. Such distortion is marked by the appearance of lines around the objects being viewed or photographed, and by hairs and other fine objects appearing double. Watch the image on the ground glass as you adjust the condenser, and open the diaphragm slightly when a point is reached at which the characteristic diffraction lines appear.

When making photomicrographs in which fine detail need not be attained, it is possible to reduce the lens opening without losing detail, so as to increase the depth of focus. Few microscope objectives are equipped with adjustable stops, as are the special photographic lenses for microscopes. However, it is a simple matter to cut "washers" from black paper, such as that in which photographic films are wrapped, and to insert these into the objective, either between the two halves, if it can be separated, or on top of the lens if it is of one piece. A paper punch, such as is used for canceling tickets or making holes in notebook pages, will be found convenient for making the circular hole in the paper disk. A good way to construct the stop is to scribe, with sharp-pointed dividers or a compass, a circle of the correct size to fit inside the lens mounting. Cut or tear the paper along the scribed line, and use the center hole made by the compass point for centering the paper punch. Insert the stop with tweezers, being careful not to scratch the lens.

MICROSCOPES with removable eyepieces frequently have tubes that are shiny inside, near the top, where the eyepiece normally fits. This shiny surface reflects light into the camera and, if it is not treated in some way, makes the picture indistinct. The easiest method is to insert *(Continued on page 100)*

MICROSCOPE PICTURES IN THREE DIMENSIONS

(Continued from page 99)

into the tube a rolled cylinder of black, dull-surfaced paper. The paper that comes with films and plates will do in many cases. Even this sometimes has an objectionable sheen that reflects too much light. It can be improved by smoking over an oil or yellow gas flame. To prevent setting the paper on fire, wrap it around an old tin can, so that the metal absorbs the heat. A very thin layer of lampblack is all that is necessary. Roll the paper with the smoked surface inside.

If your microscope has a seperable body tube, internal reflection can be eliminated and the size of the light circle increased by unscrewing the upper portion, the section that normally carries the eyepiece. This may make it necessary to change the coupling between microscope and camera, but that usually is an easy matter. A black cloth rolled into a tube or light tunnel and fastened about the camera opening and microscope tube is satisfactory.

AFTER you experiment with low-power stereo-photomicrography for a while, you will realize that a high-powered microscope is not at all necessary for traveling in the microscopic wonderland that lies all about you. Below fifty diameters is enough material to keep one microscopist busy for years, without looking at the same thing twice. Very often, objects are more beautiful when magnified only moderately.

In the kitchen of your home you will find some jewels which, at fifteen diameters, will take your breath away when seen stereoscopically. These jewels are to be found in the sugar bowl and salt shaker. Spread a pinch of each substance on black paper—the same kind used for lens stops and the tube liner. Lay each piece of paper on a slide and tap the edges of the glass sharply with a pencil, to jar the crystals out into a uniform layer. Illuminate the sugar or salt either by placing the miscroscope in sunlight, mounting a lamp bulb near the stage and slightly above it, or projecting a concentrated beam of light, from a bullseye illuminator of some sort, across the layer of crystals at a sharp angle.

Insects provide an almost unlimited supply of material. Legs, feet, mouth parts, antennae, and wings look surprisingly beautiful when seen through the stereoscope. Then there are, of course, small insects that can be photographed in their entirety. Mites and small spiders make interesting subjects. Usually the best way is to arrange the insect or part of its anatomy on a piece of gray or black paper and illuminate it as the sugar and salt crystals were. However, it frequently is desirable to have two sources of light, one stronger than the other, placed on opposite or nearly opposite sides of the stage. This is to prevent the formation of extremely dense shadows. Panchromatic plates and yellow or even red filters often will be found suitable for rendering detail in insect parts. The filter is, of course, placed between the illuminator and the object.

SOME microscopists immerse insects in a liquid such as methylated spirit, in order to improve their appearance when being photographed. A watch glass or petri dish that can be set on the microscope stage is lined with gray or black paper and filled with liquid, and the specimen submerged in it. Care must be taken not to jar the liquid during exposure. (Methylated spirit is ordinary alcohol denatured with wood alcohol).

Another beautiful subject for stereoscopic reproduction is a group of insect eggs or egg shells. These eggs exhibit an almost endless variety of shapes, sizes and surface markings. Many of them, when illuminated as the salt crystals were, or *(Continued on page 101)*

MICROSCOPE PICTURES IN THREE DIMENSIONS

(Continued from page 100)

by transmitted light, look like the handwork of some miniature jewelry maker.

Plants also afford a wide selection of material suitable for low-power photomicrography and stereoscopy. Tiny flowers and leaves and other parts can be photographed effectively with the photographic-lens set-up described.

The pollen of various flowers makes an unusually beautiful object. In many respects pollen grains are like plant eggs, as far as microscopic examination is concerned. When properly illuminated, many types of pollen grains exhibit a beautiful crystalline structure. In shape, size and surface markings they are as variable as insect eggs.

SMALL seeds such as those of the dandelion will be found worthy of attention, when stereographs are being made. The chief difficulty in many cases will arise from the dark color of the seeds, which makes proper lighting difficult. About the best plan is to use as much light as possible, diffuse it by interposing a ground glass or sheet of thin tissue paper between light source and microscope if the high lights are too glaring, and give long exposures. Sometimes the proper use of a color filter will improve the quality of the photograph. You might try submerging the seeds in methylated spirit, as described for insects.

Other promising plant subjects are leaf and stem hairs. These occur, on some plants, in unusual and interesting shapes. Along the edges of a leaf is the best place for finding these hairs. They can be illuminated by reflected or transmitted light. Usually, however, leaf hairs require somewhat too great magnification for good stereoscopic effect. Various kinds of animal hairs ought to make excellent stereographs if they can be photographed with sufficient depth of focus.

From the sea come many objects which, at low magnifications, provide unforgettable sights. A piece of cuttlefish bone or shell, such as the canary has in his cage, becomes a fairy palace of delicate spun glass under the microscope. A stereoscopic record of this formation, even though you may find it a bit difficult to obtain because of the delicate nature of the structure, is worth adding to any collection. In sea sand along beaches, and in ooze of the ocean floor, can be found shells and skeletons of tiny marine animals. No more suitable subject for low-power observation or the making of three-dimensional photographs could be desired than these beautiful shells.

The list of microscopic wonders that do not require great magnification could be prolonged for a hundred pages, and still there would be new names to add. You will have no end of fun looking at such things as woven cloth, wax impressions of the ridges and valleys on your thumb, moth "tongues," dust from a grinding wheel, wheels and screws and jewels in a wrist watch, snowflakes, the teeth of a file, crickets' wings, fish scales, sections of walnut and oak and other wood, edges of razor blades, crystals of various chemicals made by letting solutions of them evaporate on a glass slide; and thousands of other things the size of which is such that they can be appreciated under twenty-four diameters. Among such objects you will discover many that will make striking stereophotographs.

A collection of stereoscopic photomicrographs is worth the time and effort required to built it up. It will prove a source of endless pleasure. Your friends never will cease being awed by it. When making such pictures, always attach to each a record of such things as magnification, exposure, and type of plate or film used. This will enable you to make similar pictures in the future without waste of time and material.

Secrets of Success

STORIES THAT WILL HELP YOU GET AHEAD

"LEARN HOW TO USE YOUR MIND AS WELL AS YOUR HANDS"

FIGHTING his way out of the depression, William Hohwieler, Morrisville, Penna., has discovered that life *does* begin at 40—or begin again—for it's just a year ago that he put that birthday behind him and it's just a year ago that he started on his way up in the world once more.

"I suppose I've had my share of hard luck," says Hohwieler. "Maybe a little more than my share. But when things went all to pieces for me three years ago, the background of training and experience I had had enabled me to visualize new opportunities. I never gave up hope or stopped turning over the possibilities of my mental and mechanical equipment. And by 'turning over' I don't mean just sitting around and thinking. I don't believe I ever worked harder than I did in that period of trying to find myself again. Certainly, I never worked harder for less, for I didn't make a penny!

"And believe me, I know what hard work is! I was left an orphan at the age of 13 and I've worked ever since. My first job was in a machine shop and being mechanically-inclined, I made up my mind that here was what I wanted to do. I suppose by plugging along I might in time have become a foreman. But being a foreman was not the top, so I went to night school to get the technical and business training I felt I needed.

"It was there that I first became interested in rubber engineering and research work, and soon I was putting in all my spare time not only at school but at home, fussing around with crude rubber, sulphur and other chemicals. That didn't make such a hit with the family with which I boarded, but for some reason or other they tolerated my experiments and let me stay.

"Just before the War, I got a job with one of the rubber companies in Ohio and from then until 1921, I got the practical training necessary to supplement my night school studies and home work. With this as a foundation I went into business for myself as a rubber research engineer here in Morrisville.

"So far as the rubber development work was concerned I was fairly confident. But I soon found that as a business man I was a good engineer. There were a lot of things about the office side of the rubber business I didn't know. But how to learn them? That proved far less of a problem than I had anticipated, for I read about a home study course on general business and subscribed for it. There were times, I must admit, that I found those books and examinations pretty heavy going. After all, you can't push along all day in the shop and not get tired.

Secrets of Success

"But I realized the value of the course and kept at it. I can honestly say today that, overwhelming though the home study seemed at times, I look back on this training as one of the chief factors in the 'comeback' I have staged this last year. That course taught me above all else to think ahead; to project today's experiences into tomorrow and plan accordingly. It taught me to look for opportunities and if I couldn't find them, to *make* them.

"Perhaps it is not unusual that I should have found a new livelihood in my one hobby—fishing. I suppose there have been hundreds of other men who have turned what was once a recreation into a living. Anyhow, in my case, that is what happened. In the summer of 1933 I left my troubles behind me one Sunday, piled my family into the old car and drove over to the New Jersey seashore.

"The fish must have been running that day for the beach was lined with surf casters. Being, as I say, interested in fishing, I stopped to watch some of the more expert fishermen as they heaved their lines out over the breakers. I noticed that most of these men were using leather butt rests for their rods and that most of the rests were pretty badly deteriorated from the salt water.

"That gave me an idea. Why not a butt rest of rubber? It would hold its shape and, treated properly, would resist the reaction of the salt indefinitely. At least it was worth a try.

"All the way home, I kept thinking about that butt rest and the next morning I went to work on it. Fortunately, I had a good supply of crude rubber and sulphur left over from my more prosperous days of engineering research.

It would be nice to tell how, overnight, this rubber butt rest became a success but, unfortunately, that wasn't the case. For more than six months I experimented with it until I had found the right formula. It was not until the following spring—1934—that I tried to market the thing. And meanwhile, I had to sell off some of my rubber and sulphur in order to live.

"Last May, I walked into the office of a sporting goods jobber in Philadelphia to get his opinion. When I came out, he had ordered a gross. Encouraged, I went to New York and found another jobber equally receptive. Next I corresponded with a jobber on the Pacific Coast and after submitting samples, was rewarded with a surprisingly sizeable order from him. And all this, mind you, came when the season, so far as jobbers are concerned, was well advanced.

"Today I am making a comfortable living and I confidently look for bigger and better times ahead. The butt rest has suggested other fishermen's and sportsmen's equipment made of rubber and these, too, are finding a ready market.

"I believe the remedy for hard luck is hard work. But that isn't all. You've got to do some hard, intelligent thinking, too. And that takes training and study. I'll always be thankful for the 'leisure'

Secrets of Success

hours I put in learning how to use my mind as well as my hands."

DISTANCE COULD NOT CURB HIS AMBITION

The fact that he lived 'way out in the country, many miles from the nearest city, did not discourage a young Canadian man in his ambition to become an artist nor prevent him from achieving it. Ever since he could first hold a crayon, Alfred Bakstad, of Orion, Ontario, wanted to study commercial art. But going to any such art center as New York or Chicago was out of the question. Even Toronto, the nearest city, was too far away.

One day, Alfred happened upon an old copy of a magazine. In it he saw the advertisement of a home study art school. It told about a new way of learning to draw at home through the mail. Alfred was a bit skeptical as to how practical such a course of training could be. But he decided to find out more about the school and the courses it offered, so he answered the ad.

After receiving the school's literature, he made up his mind to take the course and duly enrolled. His lessons were mailed to him regularly and he received a complete set of materials as well as instructions. At stated intervals his drawings were sent to the school for criticism and advice. And though his instructors were almost a thousand miles away, his work showed steady and encouraging improvement.

Each drawing he sent in was returned with corrections made by one of the teachers. They not only showed him where his mistakes were but also pointed out how to avoid them in the future. Errors were revealed when the instructors redrew Alfred's pictures and noted where the originals were wrong.

As the result of this personalized instruction, Bakstad was hardly more than halfway through his course when he sold over a hundred dollars worth of his drawings. Other sales have followed and though still a youth, Alfred has created a market for his work with the best and most productive years of his life yet to come! In a letter to the school he writes:

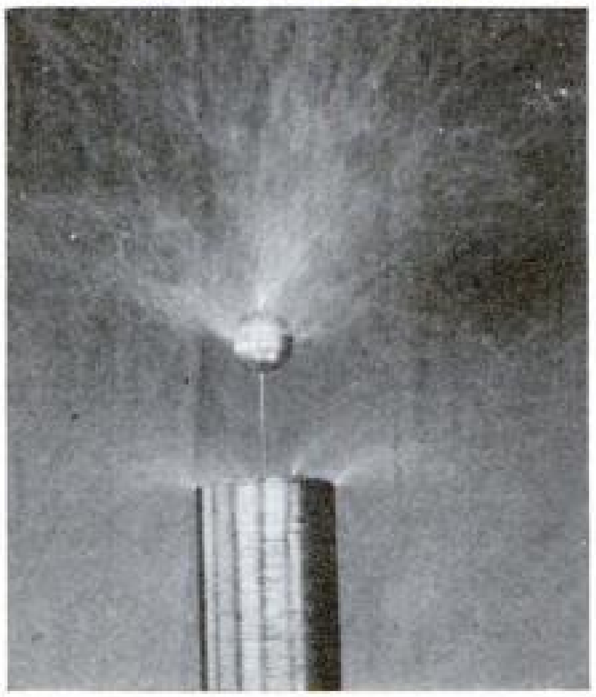
"Acting upon your suggestion, I wrote to Mr. Weishaar (a publisher) and have received a letter from him asking me to submit some drawings. I seem to have the knack of making silhouette pictures and sold quite a number to —— —— (one of the foremost women's magazines).

"I have been getting $10 each for these decorations and last month I sold two for $30. Recently I sold nine others. Last spring I sold five political cartoons to a Toronto paper and have just submitted another batch of drawings to —— ——. I received $150 for drawings last winter, which seemed rather satisfactory for an amateur living out here on a farm."

Often the question is raised: "Are home study courses practical?" Alfred Bakstad's experience seems to answer the query eloquently.

JUGGLING THUNDERBOLTS

(Continued from page 83)



Discharge from a brass ball mounted on the rod. This alone is an impressive spectacle

metal, which make contact with water in jars, should all be connected together to serve as one terminal of condenser. A wire connected to pan serves as other terminal. Begin with about six jars and add more until maximum spark is obtained from high-frequency coil. Avoid bottles or jars that contain any bubbles in glass or they will be punctured.

Rotary Spark Gap. Although a straight spark gap of the type described in the February article may be used, a rotary gap (Fig. 8) is recommended because there is less chance of a breakdown in either condenser or transformer. Any small motor capable of turning the rotary disk may be used. The motor used by the writer has a speed of 2,400 R.P.M. From numerous experiments, about 400 sparks per second seem to give best results. The number of studs in the rotating disk, Fig. 6, should give the required number of sparks per second—in this case ten studs. Old bakelite radio panels will provide excellent material, but if less than 1/4 in. thick, use two sections. The studs are 3/8-in. pieces of 1/2-in. round copper or brass rod, held on disk with roundhead machine screws. A wire connecting all stud screws is soldered in the screw-head slots. The two stationary electrodes are supported by brass or fiber posts, mounted on well-seasoned wood or a fiber or bakelite panel. Their height depends upon the motor used. It should be such that two rotary studs will come exactly opposite the stationary studs at one time. The hub upon which disk is mounted is shown in Fig. 7. This may be turned from brass or steel.

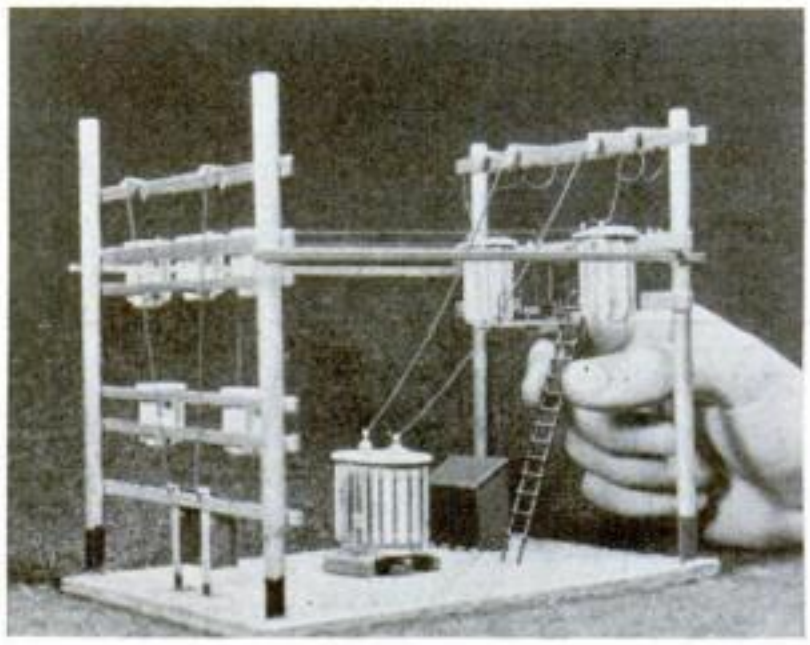
Connections. Follow diagram shown in February article, with a high-voltage transformer, giving about 12,000 volts, in place of the spark coil. An additional connection should be run from bottom of primary coil to the ground. Adjust spark gap to about 1/16 in. Vary connection from condenser along the primary turns for maximum spark.

Experiments. Many will suggest themselves. If iron or copper wire is shaped as shown in Fig. 5 and placed on brass rod at top of the coil, it will revolve and send long sparks into the air. A metal ring, Fig. 9, will produce a beautiful halo effect. If the experimenter stands on an insulated stool, he can take full discharge of coil through a metal rod without the slightest injury. If wires connected to the terminals of a 110-volt lamp are held between two persons, one of whom is taking the discharge from the coil, the lamp will light up to nearly full brilliancy. Wires up to 50 ft. long, when connected at one end to coil and insulated at the other end, will glow with a weird blue light along their full length.

Transformer Station

ADDS REALISM TO MODEL RAILWAY

By HARRY B. FUGE



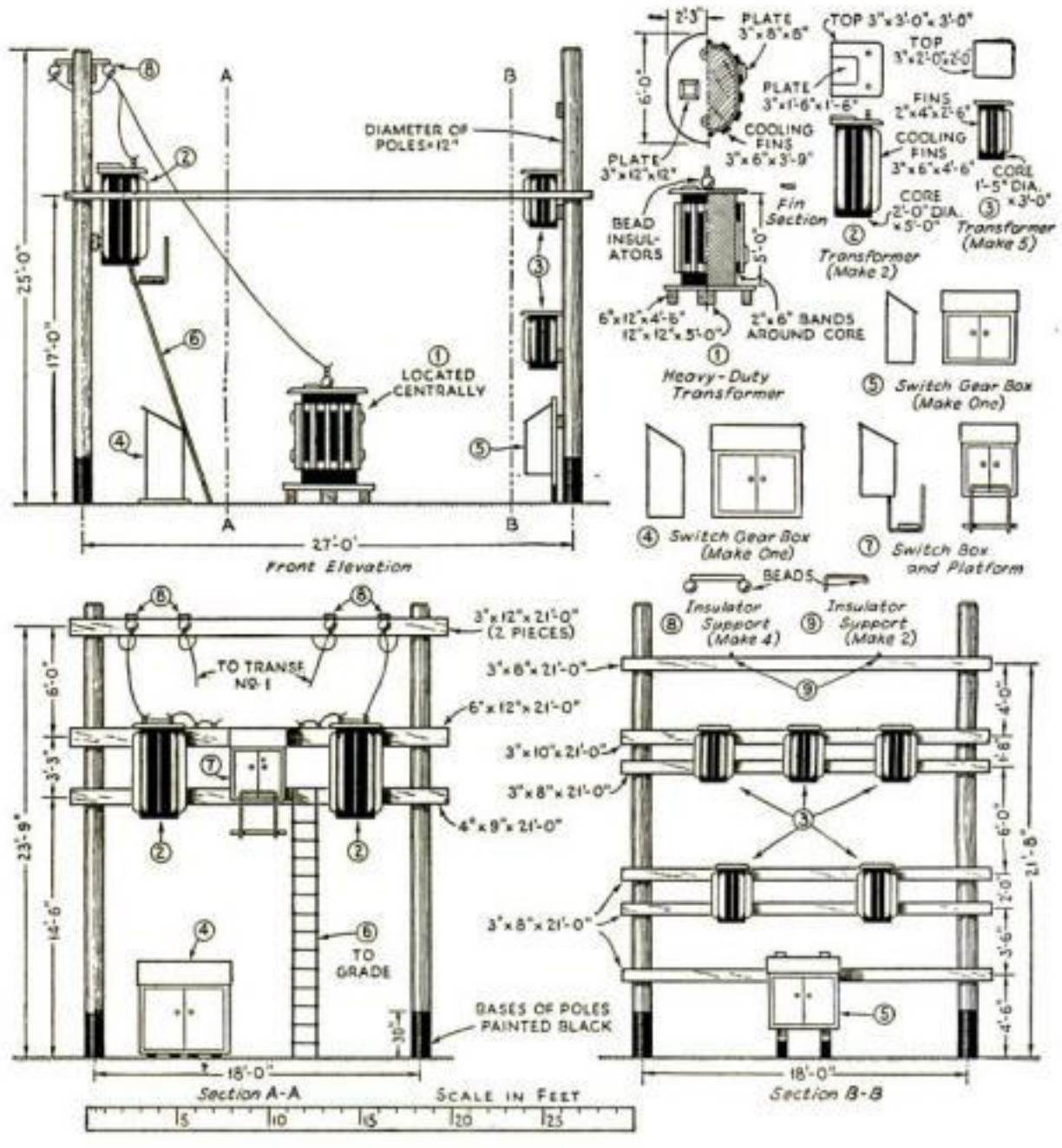
Model of a transformer station built from the plans below

IN THIS electrical age no modern model railway is complete without a replica of a high-tension power transmission line and transforming station. This may be considered to be either part of the railroad's own power system or a public utility system adjoining railroad property.

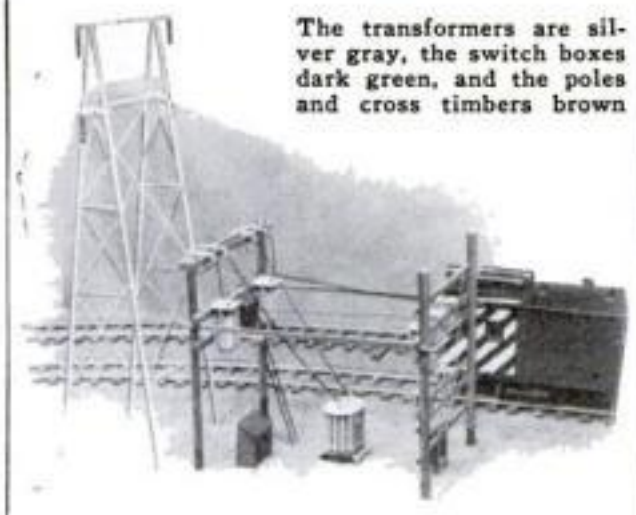
The transformer station is best constructed by mounting the four poles on a base of thin plywood or pressed wood board. All dimensions, it should be noted, are given in feet to facilitate constructing the model to any scale desired. Four pole holes should be drilled in the base, and the poles (dowel sticks) are glued in place. The base is then given a heavy coat of thick varnish, and fine sand is sifted over the wet varnish. This will give the base a sufficiently realistic appearance of earth.

The various cross arms are cut from balsa strips and glued in place. The high-tension insulator supports (No. 8 in the drawing) are balsa with a ⅛-in. glass bead fastened at each end with a pin. The low-tension lead-offs are bent pins with a small bead at the end.

When cross arms and insulators are in place, the wood is given a coat of brown creosote shingle stain, and the bases of the poles are banded with black.



The core of the large transformer is cut to shape from a solid block of wood and banded with two cardboard strips as shown. The cooling fins are then glued to these cardboard bands, ladder fashion. The insulators for this transformer consist of two small beads and a large one strung on a pin and glued to the top of the transformer. Lead-in cables of heavy black thread go from these insulators to the two inside high-tension insulators. After the



The transformers are silver gray, the switch boxes dark green, and the poles and cross timbers brown

thread has been strung, it is a good idea to moisten it slightly with a camel's hair brush to take the kinks out.

The cores of the other transformers are made of the correct size dowel stick, the tops and fins being sheet balsa. All the transformers are painted silver gray before being glued in place.

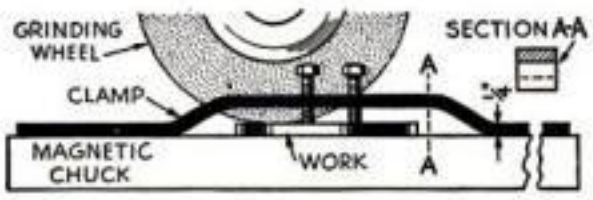
The switch-gear boxes are built up of 1/16-in. sheet balsa, but the roofs are best made of thin cardboard. The doors, cut from file-index cards, are glued in place and fitted with pinheads for knobs. The platform support for box No. 7 is bent from a piece of wire, and the wood platform is a piece of sheet balsa stained the same color as the poles. The switch boxes are painted dark green before they are glued in place.

The ladder is built of wire (see P.S.M., Aug. '33, p. 84) and is glued in place to provide access to switch box No. 7.

The transformer station is now complete except for the rest of the wiring, which is indicated in the drawings. Only the main circuits are shown, but other wires may be added at the discretion of the builder.

The construction of the terminal tower and cross-country towers will be described in another article scheduled for early publication.

BRONZE COLLARS HELD ON MAGNETIC CHUCK



WITH a clamp made as illustrated, it is possible to hold bronze thrust collars and other bronze, brass, and aluminum parts on a magnetic chuck for resurfacing them so that the sides will be parallel. As a rule very little stock has to be removed. By grinding two thirds of the surface with the first set-up and finishing the remainder with the second set-up, accuracy will be maintained, provided the vertical adjustment is not disturbed.

The clamp will also be found useful for holding thin steel stock which is likely to move around in a circle from the pressure of the grinding wheel. It is equally convenient for grinding tools of stellite, which, of course, cannot be held by means of magnetic attraction.—HECTOR J. CHAMBERLAND.

DARE-DEVIL HOBBYIST RUNS HIS OWN WILD ANIMAL CIRCUS

(Continued from page 31)

effort to harness the animals to his sleigh almost proved disastrous, for one of the elk attacked him.

"The animal came at me on his hind feet, pawing with his front feet", Walter said. "I broke the pole I had in the pen with me and still the elk came on. Just as I got to the fence and reached for an ax handle, the beast hit me in the face with a hoof, striking me between the eyes and temporarily blinding me. I hit him in the head with the ax handle and scrambled over the fence."

While Walter was anxious to complete the task of breaking the team and did make several other efforts, he was frustrated by the low altitude of Houston. Climatic conditions caused four of the animals to die within a few weeks.

ONCE, while helping to train a lion to ride a horse, Walter had an exciting inning when the lion left the howdah on the horse's back and sank its teeth into the animal's leg. Walter tried to beat the lion off the horse with a stick, but it merely clawed at him and the horse kicked at him. Before the battle ended, the horse had kicked the lion over Walter's head into the side of the arena, stunning the big cat, and the trainer succeeded in getting the horse out of the cage without further injury.

On another occasion, Walter received a deep gash in his arm when attacked by his pet monkey. He had the fight of his life when a lion he had tied down with ropes for doctoring, broke the hemp thongs and, angered because its master had poured hot medicine on a wound, attacked him. Walter fought the beast off with a chair until help reached him.

"It's all a part of the game", he says of his exciting experiences. "When I have had such a narrow escape, I really relish going back into the arena with the animal to observe its reactions and put it through its paces again."

One of the most accomplished of his domestic animals is High Power, an ordinary billy goat which Walter rescued from the municipal pound and, in two weeks, taught to walk a high wire. High Power was first induced to walk up a board on which cleats had been nailed for footing. From time to time the incline was raised until it was twenty feet in the air. In the meantime, Walter had taught the goat to walk a wide board and then two strands of heavy steel wire, spaced far enough apart for the animal to stand normally with one front and one hind foot on each strand. Now the goat walks up the approach and across the span of wire, pauses on a pedestal, turns around and walks back across the wire and down the ladder.

The same feat is performed by Queen, a common cur dog, also a former inmate of the city pound. Brindle, a great Dane, has been taught to work in the arena with Congo, the lion, mounting pedestals and going through the routine preliminary to the fighting act. Sonia and Czar, Russian wolf hounds, do broad and high jumps, and a Belgian Pomeranian, Binghi, and a Scotch terrier, Bonnie, jump through hoops, walk on their hind legs and mount pedestals. For comedy relief, there are three German dachshunds, which Walter dresses in clown suits.

AMONG the other animals that Walter has trained are a zebu, or sacred cow, which works in harness and pulls a wagon; a Shetland pony, which is being taught to kick footballs, and Pete, a spider monkey. Not content with his present collection, Walter plans to train a white fallow deer which he recently purchased, and several other dogs are to be added to his canine troupe.

While the Houston man has owned animals for years, it was in 1932, when he was invited to entertain the children at an orphan's home, that he conceived the idea of enlisting the aid of his wife in the presentation of a complete animal show. Since that time, he has given dozens of performances, sometimes viewed by as many as 3,000 children—always orphans, indigents, or crippled children from institutions—not only in Houston, but in Beaumont, Galveston, and other neighboring cities. The performances are always given free of charge and Walter provides the popcorn and lemonade for his audiences.

WHEN the amateur trainer decided to "go on the road" to neighboring towns for the entertainment of unfortunate children, there was a problem of transportation. He has built cages for the animals and is particularly proud of the four-wheel trailer he designed for the horses. It is entirely enclosed, resembling a box car, and the horses are comfortably stabled in removable stalls with additional storage space for saddles, harness, trappings, and properties used in the act.

Performances are given in the open on playgrounds, public parks, at riding academies, and in coliseums with the spectators often seated about on the lawn to watch the show.

He keeps the lion, monkey, and dogs in cages on the rear lawn of his home, while the zebu, elk, horses, and mule occupy stalls in a stable in the industrial section of Houston.

Walter values his animals and equipment at $7,000, and already his menagerie is costing $150 a month for feed and stable help. "I'm afraid," he said smilingly, "that I'm going to have to take the show on the road if I intend to keep it. The expense of maintaining it is pretty big."

Nevertheless, he visited half a dozen Houston children's homes and hospitals during the winter, promising a show in the spring, "bigger and better" than ever before.

CHEMIST REPORTS HE IS FIRST TO SEE MOLECULE

THE first man ever to glimpse a molecule is Prof. George L. Clark, University of Illinois chemist. Peering through a powerful microscope, he reported recently, he sighted egg-shaped objects .00006 of an inch long, and identified them as giant molecules of natural rubber. Because of their extraordinary size, which chemists had not hitherto suspected, they came just within the range of microscopic vision. A molecule is the smallest subdivision of a compound known to man, in which the distinctive chemical properties of the substance are maintained; the molecules of most substances, such as salt, sugar and starch, are far too tiny to be revealed individually by the most powerful lenses.

WILD DUCKS FLY ACROSS NATION AS PLANES DO

WILD ducks follow cross-country airways of their own, according to Federal naturalists who have just completed a study of their migration. Four such routes cross the United States in a north-south direction, which the investigators have designated as the Atlantic, Mississippi, Central and Pacific "flyways." Birds of a given flock habitually follow the same "flyway" from year to year, although, at their destination, they may mingle with other flocks using different routes. Hence, if too many ducks are killed by sportsmen in one "flyway", conservation in another lane will not restore their abundance.

EXPERIMENTS WITH OXIDES OF NITROGEN

(Continued from page 47)

blue color is observed. This indicates the formation of still another oxide of nitrogen. A glowing match held at the mouth of the U tube during the foregoing experiment bursts into flame, due to the escape of oxygen gas, which is not liquefied by the freezing mixture. A glass U tube at least half an inch in diameter should be used for the experiment, or the fresh gas being generated will spatter the liquid out of the tube.

IT IS a good idea to heat the lead nitrate just to the point where reddish fumes commence to appear, before connecting the apparatus with the U tube. This removes water in the crystals, which burst apart with a crackling noise like tiny white firecrackers. The amusing phenomenon is known to chemists as decrepitation.

In several ways, nitrogen peroxide resembles carbon dioxide. Each contains two parts of oxygen to one of nitrogen or carbon, respectively. Both extinguish substances burning at comparatively low temperatures. Both produce acids when they dissolve in water; you can detect the acidity produced in dissolving nitrogen peroxide by testing the solution with blue litmus paper.

In the spectacular process of capturing nitrogen from the atmosphere, air is blown through an electric arc and a part of its nitrogen and oxygen combine to form nitric oxide. As this cools, it turns to nitrogen peroxide, and the latter with water yields nitric acid. In peace times, the acid is mixed with slaked lime to yield calcium nitrate, a fertilizer; in time of war, it is concentrated by distillation for the manufacture of explosives.

HUGE EXCESS OF ARSENIC PUZZLES SWEDISH MINERS

THOUSANDS of tons of unwanted arsenic, as hard to dispose of as old razor blades, are embarrassing to operators of a gold mine in the extreme north of Sweden. The poison occurs as an impurity in the rich deposits of gold ore of the region. To the dismay of the operators, it is still on their hands in concentrated form, after the gold has been extracted from the ore,—and in what quantities! For this one mine produces, unwillingly, as much as the whole world uses. The deadly stuff cannot be sold or given away at the site of the mine, nor can it be left lying in unguarded heaps like other waste materials. Engineers first tried dumping it into the Baltic Sea, in sealed containers, but this proved too laborious to be practical. Now they have built an enormous silo of concrete, shaped like a dirigible hangar, and of comparable size, that will hold 200,000 tons of the poisonous by-product. In five years, however, this will be full. Then the operators must decide whether to build a new depository, or to seek another solution for their problem of "the poison that comes from gold."

CURIOUS SODIUM OXIDE MORE CAUSTIC THAN LYE

SODIUM monoxide, a laboratory curiosity that few chemists have ever seen, may soon be available on a commercial scale. Called a "supercaustic" this substance even exceeds lye in chemical vigor, virtually tearing water out of most organic matter. In this process, it becomes transformed into highly concentrated sodium hydroxide, and the heat thus evolved augments the effect of the chemical. The new process of manufacture involves permitting metallic sodium to combine with oxygen under restraint, yielding a highly active oxide.

ODD MENTAL KINKS PRODUCE STRANGEST CLASS OF CRIMINALS

(Continued from page 41)

Another large psychopathic group is composed of men who have become addicted to drugs or alcohol. Many psychopaths become habitual swindlers. Relatively few of them drift into a life of violent crime.

DR. LIND has studied the life histories of many psychopaths, and has found that they follow pretty much the same pattern. The usual type, when a small boy, is guilty of various not-very-serious juvenile delinquencies. He doesn't do well at school, and either is expelled or quits before he gets through the grammar grades. After that he drifts from job to job, seldom holding one for more than a few months. Then he develops a propensity to some particular form of crime, which he follows with but little variation throughout the rest of his life. He gets put into jail time after time, but always repeats his offense shortly after he is released. Punishment has no effect on him. And neither has kindness.

One of the distinguishing marks of the psychopath is that nearly always he is likeable. His most dangerous weapon against society as he goes through life committing crime after crime is his ingratiating personality. Usually he is such a charming fellow that few people are hard-boiled enough to refuse to give him the "just one more chance" for which he pleads. Even physicians who have been dealing with men of this class for many years have to be always on guard to keep from being fooled by them.

The likeableness of the average psychopath is so pronounced that the medical officers at St. Elizabeth's take the characteristic into consideration when they make their first rough working diagnosis of the case of a new patient transferred from one of the Federal prisons. If, when they consult about the case, they find that they all liked the man on their first contact with him, they usually agree that he must be a psychopathic personality. But if they find that they all disliked him, they usually agree that he is not a psychopath.

Psychopaths often are shrewd, and some are highly intelligent, but all lack judgment.

THERE is at present at large—and being looked for by agents of the Department of Justice—a swindler who combines the qualities of shrewdness and lack of judgment to an unusual degree. This fellow wanders about the country working a check racket that usually is successful, but that never brings him any substantial gain.

Going into a new town, the first thing he does is to engage a room at a hotel, and then write out, in his own favor, several checks for large amounts, signing them with names such as "John D. Rockefeller," "J. P. Morgan," "Henry Ford," and even "George Washington." These checks he conceals in his suit case. Then, using a check of a bank in some far-distant part of the country, he writes another check for a thousand dollars or so, also in his own favor. This check he deposits in the local bank, for the purpose of opening an account.

For several days he makes no effort to draw against this deposit. Then he drops into the bank to cash a check. The teller is sorry, but the check on the out-of-town bank hasn't been paid as yet. The swindler asks to see the president or cashier, and explains that he is short of ready cash for living expenses. Here the psychopath's characteristic likeableness and plausibility gets in its work, and enables him to induce the banker to allow him to draw $50 or even $100. He makes no attempt to get out of town with his loot. Instead, he spends it on good living until the check that he has deposited comes back marked "no account".

Naturally, the local banker has him arrested. Police officers search his suit case, and find the Rockefeller, Morgan, Ford, and George Washington checks. Under questioning the swindler breaks down and confesses that in the past he has been under observation in St. Elizabeth's and other institutions for the insane. The bank's money is gone beyond recall. The banker shrugs his shoulders, and suggests to the police that they let the poor fellow go. The police give him a good talking to, and he leaves the town as penniless as he was when he entered it.

THIS particular swindler shows a good deal of shrewdness in planting the "cuckoo" checks in his suit case, and, when he is arrested, in playing up the fact that he has been confined in hospitals for the insane. But he shows the psychopath's characteristic lack of judgment in devoting his considerable talents to a racket that never gets him more than a few days of good living.

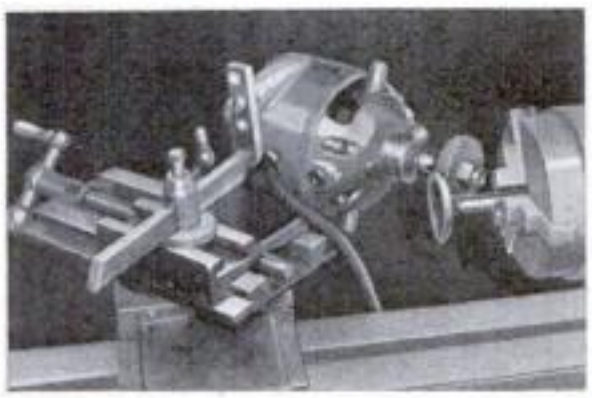
Science is being brought into play to solve the problem of the psychopathic criminal—to decide what should be done with him for the protection of society and for his own good. As Dr. William Healy, a leading criminologist, points out, the first need of courts that deal with human problems is scientific knowledge of the qualities of the human beings whose fates they must decide. New York, Los Angeles and some other large cities now are supplying their courts with this vitally essential knowledge through the employment of highly trained court psychiatrists.

All criminals, of course, are not psychopaths. Bad environment may turn a boy of normal mentality into a criminal. Early in his apprenticeship he is likely to run afoul of the law, and to be sent to a reform school. If it happens to be a reform school of the old type, he will come out much more a criminal than he was when he went in. Reforming reform schools is one of the methods that Dr. Lind suggests for reducing crime.

"In criminals of normal mentality," Dr. Lind says, "there often is much good—qualities of loyalty and courage and generosity that make them worth working long and hard to save. The penal farm, and properly conducted parole and probation systems, help greatly. Even psychopaths often can be greatly helped by understanding supervision and advice during the earlier years of their lives. But if they have not been cured before they become adults, most of them are—in our present state of knowledge of their disease—hopeless. I am not at all sure that they should be punished, but I am sure that they should be isolated for the protection of other people. Some day science may find a way to cure them. Until then, arrangements should be made for them to lead lives of their own, in communities of their own."

MANY other leading criminologists and psychiatrists agree with Dr. Lind. They are convinced that instead of being sent to prisons or asylums for a few months or years, and then thrown back into a world for which they are not fitted, these unfortunates should become self-supporting citizens of special communities designed to meet their needs. Under scientific supervision, and with certain restrictions made advisable by the peculiarities of their inhabitants, these communities could be self-governing. The people who lived in them could have their own industries, their own recreations, their own lives—much happier and less harried lives than are possible for them under present conditions.

USING SMALL MOTOR AS TOOL-POST GRINDER



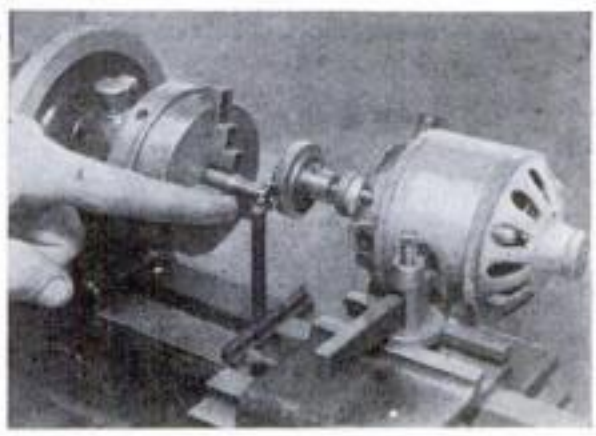
How the grinder is set up in the lathe for refacing valves and work of similar nature

WITH a simple homemade bracket like that shown and a sewing machine motor, any amateur machinist can convert his lathe into a universal grinder at a moment's notice and use it for facing valves, grinding reamers and milling cutters, and countless other precision grinding operations.

The bracket is a piece of ¼ by ½ in. cold-rolled stock 6 in. long, with a combination one-quarter turn and right-angle bend 2½ in. from one end. Two or three holes are drilled to suit the motor. The long arm of the bracket is held in the tool post.

Should your lathe not be equipped with an indexed spindle, a simple set-up like that shown in the photograph below will hold reamers, milling cutters, or other self-indexing stock in perfect alignment. The flutes of the reamer or cutter act as a ratchet, and the upright, resting on the bed of the lathe, (in this case an extra tool bit shimmed to the proper height) serves as a pawl. Note that for work of this type the shorter arm of the bracket extends to the rear of the slide rest and is turned downward.

When it is necessary to work on stock that is not self-indexing, the cuts should be laid out with dividers and the spindle clamped firmly in the proper position for each successive cut.—R. G. BULLARD.



For cutter grinding, the wheel's elevation can be adjusted by means of tool-post rocker

PIPE-WRENCH HINTS

WHEN the teeth of a pipe wrench become worn, they may be restored in the following manner: Clamp the tool in a vise and apply over the toothed surface a paste made of emery or other abrasive powder (about grain 100) and kerosene. Then, with a three-cornered file, dress both edges of each tooth till it is sufficiently sharp. Keep rubbing the abrasive under the working edge of the file, as the file alone will hardly touch the steel.

It is sometimes difficult to make a pipe wrench "bite" on a very small pipe or bolt. By fitting a piece of gas pipe about 1 ft. long over the lower end of the moving jaw and having a helper pull on this piece while the tool is being applied, the teeth can be made to take a grip where they otherwise would slip.—H. O. CARRINGTON.

HERE'S THE ANSWER

(Continued from page 57)

or foil until the apple is ripe enough to pick. All that part of the skin that has been hidden from the sunlight will be nearly white, and will stand out in very pleasing contrast.

Rejuvenating a Typewriter

Q.—HOW CAN the roller, or platen, of a typewriter, be softened?—H. O. P., Bremerton, Wash.

A.—ONLY THE surface of the roller hardens, ordinarily. Remove the roller from the machine and rub it evenly but briskly with fairly rough emery paper, until you have a new and soft surface.

Wood for Screen Doors

D. A. K., LANCASTER, PA. For making screen door frames, straight white pine, one and one eighth inches thick, is best. The stiles and top rail may be three and one half or four inches wide, and the bottom rail seven and one half inches wide. Dimensions, of course, are matters of personal preference.

A Dog's Daily Banquet

Q.—I HAVE an eight-weeks-old Springer spaniel. What is a good diet for him?—F. G. S., Burlington, Iowa.

A.—BOIL a large pot of good oatmeal for him every morning, with fresh vegetables and soft meat scraps. Add a quart of milk to the mixture, and three or four tablespoonfuls of ordinary cod liver oil. Give the spaniel half of the food in the morning and half at night. Do not give him any fresh or cooked salmon or any bones of chicken, turkey or guinea fowl.

Why Rumble Seat?

Q.—I HAVE often wondered why the open back seat of an automobile is called the rumble seat. Can you tell me why?—H. F. C., Detroit, Mich.

A.—IN THE old coaching days, servants rode on the open back seat of the coach, ready to descend at a moment's notice to open the door for master or mistress. They sat just above the rear wheels, which rumbled constantly while the coach was moving. The present-day sporting coach or tally-ho has a rumble seat.

When Books were Scrolls

Q.—WHY IS a book called a volume?—S. L. S., Chicago, Ill.

A.—THE FIRST "books" were written on papyrus, a paperlike substance made of the pith of reeds. They had to be rolled up when they were put away. The word volume comes from a Latin verb meaning to roll.

The Strange Sahara

P. G. S., SYKESVILLE, MD. Contrary to popular belief, the Sahara Desert consists not so much of sand, as of bare granite, rubble, and quartz pebbles. In elevation, it varies from 100 feet below sea level at its bed, to 8,000 feet above sea level; it contains jagged peaks. In area, it is about equal to all of Europe excluding the Scandinavian Peninsula;—about 3,500,000 square miles.

Sky Painting at Sunset

M. B. W., EDMONDS, WASH. The brilliant colors of sunset are most beautiful when the sunlight passes through much dust suspended in the air. Red and yellow rays, too, are best seen through the dense atmosphere close to the surface of the earth, near the apparent horizon.

UNIQUE NEW WAY TO MAKE

Celluloid Novelties

FROM OLD PHOTO FILMS

By Kenneth Murray

The celluloid parts of this dress set are made of films welded together with acetone

ATTRACTIVE and individual in design, this man's dress set—cuff links, tie clasp, and identifying tag or fob for a key chain—can be made from old photographic films after the emulsion has been removed, or from scraps of automobile side curtain celluloid. The variety of patterns is limited only by your imagination, and they are made inside the celluloid, as it were, to give the appearance of onyx or other stones.

If you do not care to use your old camera films, almost any photographer will be glad to give you a handful of thicker portrait films for which he has no further use. When possible, select those marked "safety base" on the edges. This type is practically noninflammable; at least, it burns very slowly. Soak them overnight in a strong lye solution so that the gelatine emulsion can be wiped from each side with rubber gloves as shown in one of the illustrations.

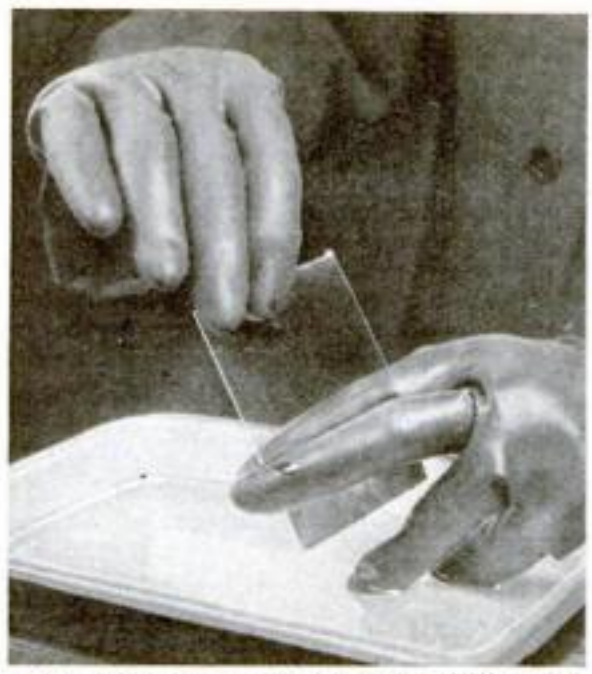
Purchase a set of cuff links and a tie clasp at a five-and-ten-cent store. Remove the ornamental parts so that they can be replaced with what you intend to make from the celluloid.

Starting with the cuff links, cut the celluloid into enough ¼-in. squares to form a pile ¼ in. high when pressed together. Divide them into four piles, one for each link. On each square place a number of tiny dots with a brush and white lacquer, as illustrated. This will give an onyx or agate design when the squares are welded together. Later you can try your hand at other designs in different colors of lacquer.

Holding one of the squares between thumb and finger, flow acetone on it liberally from an eye dropper. The celluloid will swell and absorb the liquid. Before it can dry, press another of the squares over it tightly. The small lacquer dots will spread out into different shapes. When more squares have been added in the same manner, a most unusual design will be seen entirely through the block of celluloid. Place each block between scraps of wood in a vise or clamp, using light pressure to drive out all air bubbles. When the blocks are thoroughly dry, you can file down the edges; and after they are smooth and even, flow the edges with acetone, which will restore the polished appearance.

Fill each of the metal link parts with composition wood or other suitable filler, and

Small dots of lacquer are placed at random on squares of celluloid as shown in the upper view. When the squares are cemented together, the block can be filed to any desired shape. *At left:* The lettering and monogram are drawn large and photographed



Rubber gloves are worn while stripping off emulsion after films have been soaked in lye

when this is dry, sand the surface smooth. Flow one side of each celluloid block with acetone until it is quite soft; then press it into contact with one of the metal parts, using a vise if necessary. The joint should dry overnight before handling further. The personalized facings for the cuff links will be described after the making of the other two parts of the set.

The ornament for the tie clasp is made in the same manner. Cut a triangle from heavy cardboard, each side being about 1⅛ in. Use this as a template to cut out celluloid pieces to make two trianglar blocks, each 3/16 in. thick. They are then welded together with the metal part of the tie clasp between.

The key chain identification fob is made with sufficient 1 by 1¼ in. pieces to give a thickness of ⅛ in., and two corners are filed off after the block is dry. A hole is drilled in one end to take a metal shoe eyelet.

Each part of the dress set is finished with a neat facing—a monogram for the cuff links and tie clasp, and an identification for the key-chain fob. This can be done very easily with your camera. Make the drawings with India ink on white paper or cardboard. They should be quite large so that any slight imperfections will not show when the drawing is reduced. Be sure to keep the proportions correct so that the reduced copy will fit, especially in the case of the key-chain fob.

If you use a roll-film camera, remove the back and hold a piece of ground glass or thin tracing paper over the film rollers to determine size and focus. If your camera has a cut-film or plate back, load with slow "process" film; otherwise, use ordinary slow roll film without color sensitiveness. Develop the negatives for a rather long time to give contrast, and print them on thin negative film, through the back. These positives are welded with acetone to the faces of the celluloid blocks you have already made. Hold them in a vise until dry, then trim off the edges neatly with a razor blade.

HOW TO ETCH NAMES AND INITIALS ON ALUMINUM

ALUMINUM cups, pans, and other utensils can be easily etched with names and initials by protecting the background with asphalt varnish and doing the etching with hydrochloric acid mixed with an equal quantity of water. First paint the space with asphalt. When this is dry, either make the lines with the blunt end of a needle, or remove the resist by applying benzine with a bit of cotton wrapped around the point of a toothpick. To keep the acid where it is wanted, a wall of putty may be built up around the part to be etched.—C.L.

DOES LATEST DISASTER SPELL THE DOOM OF THE DIRIGIBLE?

(Continued from page 27)

hailed as a hero. Public subscriptions for building a second machine, the *LZ-2*, reached a total of more than a million dollars. Dogged by ill-luck, the new nine-ton craft, which was completed in 1905, first dove into the water and later was caught by a gale, torn from its moorings and reduced to a tangle of wreckage.

UNDAUNTED, Count Zeppelin built other ships, each better than the preceding one. In the summer of 1908, he flew the *LZ-4* over the Alps to Zurich and Lucerne and back to Friedrichshafen, making the 235-mile journey at an average speed of thirty-five miles an hour.

The following month, the same ship landed at Stuttgart to repair an ailing engine during government trials. Here the jinx which has pursued the Zeppelin-type craft throughout its thirty-five years of existence struck again. A sudden gale wrenched the great dirigible from its moorings. Shooting aloft, a derelict in the sky, with no one on board, it reached an altitude of 3,000 feet, exploded like a paper bag, and crashed to the ground in a sheet of flames.

During 1909, plans were pushed for a journey to the North Pole in a Zeppelin but the scheme was later abandoned. The next year, passenger service began in Germany. The first trip from Friedrichshafen through Stuttgart and Cologne to Düsseldorf was made in the *LZ-7*, christened the *Deutschland*. The airship was equipped with a restaurant and special cabins for the passengers. On its third flight, it was carried by a storm over the Teutoberger Forest. With gasoline tanks dry and gas bags leaking, it fell into the trees and was wrecked. However, the thirty-six passengers, miraculously escaping death, climbed down a rope ladder to safety.

Between 1910 and 1914, the four passenger liners of the Zeppelin fleet traveled more than 100,000 miles, spent more than 3,000 hours in the air, and carried 34,000 passengers without a serious accident. In fact, up to the fall of 1913, when Zeppelin had built twenty-six airships and had seen more than half of them destroyed by crashes, not a single fatality had resulted.

But in that year the toll of lives began to be taken. In September, a storm hurled one of the great ships into the North Sea, drowning the crew of thirteen. Three weeks later, the *LZ-18* exploded in mid-air over Johannisthal and twenty-five men were killed.

With the beginning of the World War, the Zeppelin plants hummed with activity. They turned out more than seventy air cruisers in the four years of hostilities. Under cover of darkness, these huge ships bombed London, Paris, and other enemy cities, causing considerable damage. Records show, however, that planes carried more bombs over these cities than did the Zeppelins, and the war ended with the military value of the rigid airships still represented by a question mark.

IN THE midst of the struggle, Count Zeppelin died at the age of seventy-nine. Had he lived a few weeks longer, he would have seen one of his airships complete a remarkable 5,500-mile flight over Africa carrying twenty tons of medical supplies for colonial troops. The distance, made at an average speed of almost a mile a minute, stood as a non-stop record for more than a dozen years.

On the day the Armistice was signed, workmen at Friedrichshafen were putting finishing touches on the biggest Zeppelin so far built, the *LZ-72*, which was said to have been designed to bomb New York City. Six engines, with a total of 1,440 horsepower, drove the 770-foot machine. Its hydrogen capacity was 2,470,000 cubic feet and its fuel tanks held 11,000 gallons of gasoline, sufficient for a non-stop flight of 9,500 miles.

By the terms of the Versailles Treaty, this giant craft was turned over to the French and later christened the *Dixmude*. In 1923 the jinx caught up with it. It disappeared over the Mediterranean and was never seen again. A few weeks afterwards, Sicilian fishermen hauled the body of its commander out of the sea in their nets. That was the only trace of either crew or ship that was ever found. One theory is that the dirigible was struck by lightning, crashed, and sank.

IN GREAT BRITAIN, the first attempt to construct a Zeppelin-type craft was made in 1911. When the $400,000 dirigible was completed it was christened the *Mayfly*. Soon wits were dubbing it the *Won't-fly*. Unable to lift its own weight, it collapsed before it got off the ground.

Two other English machines were started during the latter days of the World War. Made secretly in Scotland for reprisal bombings in Germany, they were completed after the Armistice was signed. One was named the *R-33*, the other *R-34*. The latter was the first airship to cross the Atlantic.

Before daylight, one morning in the spring of 1919, it rose into the fog and headed out over the sea. Lifted by 2,000,000 cubic feet of hydrogen, it carried sixteen tons of gasoline and a crew of thirty-two men, including Lt. Comdr. Zachary Lansdowne, an American officer who crossed in the ship as an observer. All of the men wore parachutes and when the ship reached Roosevelt Field, L. I., Maj. J. Pritchard, one of the officers on the dirigible, leaped overboard to direct the landing crew on the ground below. The journey was completed in 108 hours. On the return, with favoring winds, the *R-34* covered the 3,200 miles in seventy-five hours.

It was five year before another sky cruiser spanned the Atlantic. This was the *LZ-126*, later known as the *Los Angeles*. Built at the Zeppelin plant at Friedrichshafen, it was turned over to the United States under the agreement of the Versailles Treaty. It was 658 feet long and its 2,600,000 cubic feet of lifting gas enabled it to carry a load of more than seventy tons. With Dr. Hugo Eckener in command, it crossed the Atlantic in eighty-one hours and seventeen minutes. For eight years, until it was taken out of commission in 1932, it was flown successfully by United States Navy men.

Before the *Los Angeles* reached this country, however, the Navy already had a dirigible of home construction, named the *Shenandoah*, an Indian word meaning "the daughter of the stars." It was designed by Commander Jerome C. Hunsaker of the United States Navy. With a duralumin framework and gas cells holding 2,115,500 cubic feet of non-explosive helium, it cost approximately $2,000,000 to build. For two years it flew with spectacular success. The *Shenandoah* seemed to have sidestepped the bad luck which runs like a recurring theme through the story of the Zeppelins. Under the direction of Lt. Comdr. Lansdowne, it traveled from coast to coast, visited seventeen states and made a 9,000-mile flight without an accident. The next year, however, it came to an end, sudden and tragic, over the cornfields of Ohio.

AT THREE o'clock on the morning of September 3, 1925, it struck a line squall over Marietta. Surging currents in the boiling air snapped the framework of the great ship. It tore into three separate floating fragments and crashed to earth, killing fifteen members of the crew including Commander Lansdowne. *(Continued on page 115)*

DOES LATEST DISASTER DOOM THE DIRIGIBLE?

(Continued from page 114)

Other major disasters have followed one another in recent years. Again and again misfortune has struck and the aerial giants have come crashing from the sky. In 1921, the British-built *R-38,* destined for the United States, dropped like a flaming meteor into the Humber River at Hull and carried forty-four men to death. Five years ago, the *R-101,* a palatial airship intended for service between England and India, crashed into a hillside fifty miles from Paris, exploded, and burned. Only seven of its fifty-six passengers escaped alive.

IN SPITE of the success of a sister ship, the *R-100,* which flew to Canada and back, the terrible tragedy in France completely discouraged the English with Zeppelin-type machines and they abandoned the field in disgust.

The most famous of all the dirigibles which have come from the Friedrichshafen factory in Germany is the *LZ-127,* better known as the *Graf Zeppelin.* This queen of the skies has flown to America, has operated on a regular schedule between Germany and Brazil and, in 1929, circled the globe in nine days, twenty hours and twenty-three minutes flying time. During this epoch-making journey, it flew 6,980 miles without a stop, between Friedrichshafen, Germany, and Tokyo, Japan, establishing a world's record for distance.

In 1926, the United States Congress appropriated $8,000,000 for the building of two super-dirigibles, the *Akron* and the *Macon.* To provide a factory for the work, the biggest building on earth, a huge streamlined hangar, was erected on the outskirts of Akron, O. Every aid of science was employed in the design and construction of the air giants.

Nearly 800 feet from nose to tail, they held 6,500,000 cubic feet of helium, carried five airplanes in a special housing section and contained a nervelike system of wires that provided telephone communication between the control cabin and all parts of the ship. Every precaution was taken in the building and housing of the ill-starred airships. Yet, their tragic fate is familiar to all. At opposite sides of the continent, they crashed and carried men to death.

Thus, the long road followed by the rigid airship from the floating hangar of Friedrichshafen to the waters off Point Sur has been studded with disasters. The big dirigibles have come down in flames; they have broken up in the sky; they have crashed in landing; they have exploded in mid-air; they have been blown out to sea.

SINCE 1913, 350 men have lost their lives in airship disasters. Seventy-three went down with the $5,375,000 *Akron;* fourteen died on the $2,200,000 *Shenandoah;* forty-four on the $1,500,000 *R-38;* forty-six on the $2,000,000 *R-101;* fifty disappeared with the *Dixmude.* Since the World War, alone, the United States Navy has spent $40,000,000 on dirigible airships and equipment.

The *Graf Zeppelin* has shown the possibilities of the big rigid dirigible; the *Akron,* the *Macon,* the *Dixmude,* the *R-101,* its dangers.

England, completely discouraged, has abandoned the idea of further construction. President Roosevelt has announced that no appropriations for other dirigibles are now forthcoming. Only Germany, where the Zeppelin was born, remains an active proponent of the air giants.

What lies ahead? Has Zeppelin's dream of flying hotels and sky leviathans come to an end?

PICTURES IN COLORS OPEN NEW MOVIE ERA

(Continued from page 15)

than an added color to the screen. It not only makes possible presentation of scenes in a wider variety of perfect colors, but also gives clear outlines.

Moving-picture cameras never give to the screen precisely what the director sees, for the range of sensitivity of the human eye is from ten to twenty times greater than any photographic emulsion. For black-and-white pictures, grease paint and make-up are applied to actors in terms of black and white silver emulsion in an effort to get a maximum of modelling and satisfactory shadows. Directors have exactly the same problem when dealing with colors, yet many rich combinations of blue, red, and green give to the screen beauty and realism hitherto impossible.

AS I observed the color camera in operation, I noted that the set was lighted somewhat more brilliantly than for black-and-white photography, while colored gelatins placed in front of the lights provided desired tones. The camera was focused by remote control by an operator who estimated the distance to actors and applied changes by turning a handle which adjusted the focus.

A cameraman looked through the viewing device at a photo-electric light-measuring instrument placed in the position to be taken by the actor. Three times he took readings, one with the cell aimed at the camera and two while it pointed at an angle of forty-five degrees right and left. From the average of the three intensities the exposure was calculated. The color director strode about the set viewing it in perspective through a camerometer, which produces a stereopticon effect.

Color in pictures does not mean that the screen will be deluged with brilliant hues. Color, Jones told me, is rather the "tone" of a picture, or the underlying harmony of all tones. Each square inch of the picture must be related to every other square inch.

The colors appearing on the screen are true to art rather than to life. "In low shadows," Jones explained, "colors seem less true than those in the white or lighter range. In a painting by Rembrandt, the shadows and half lights are richer than in nature. For the same reason, we concentrate lights in the background to make them richer. Even in the most realistic paintings, colors are not true to life. Place your hand alongside a hand in a painting. A Rembrandt hand will be somewhat more amber in color.

"So we are using, not actuality, but the great mass of the world's painting masterpieces as our guide. Laws of color in moving pictures are the same as in painting. The color in paintings is not the actual color of the skin. A subtle transformation has taken place. The colors are arbitrarily chosen to enhance the mood. These paintings are real and true, but not actual as to fact."

HOLLYWOOD stands on the verge of a great color expansion. If "Becky Sharp" explodes the moving picture industry into a race for color, the color laboratories will be swamped. Although there are many systems of color, only five color-process laboratories are operating on the West Coast.

The moving-picture industry waits at the starting line, ready to pour millions into color. Color is even being planned for newsreels. How quickly a colored newsie can be turned out was demonstrated when one company showed in fifteen Southern California theaters views in color of the Pasadena Tournament of Roses parade six and one half hours after the last float had passed the camera.

Another possibility of the use of color, now being studied in film laboratories, is the projection of colored movies by television.

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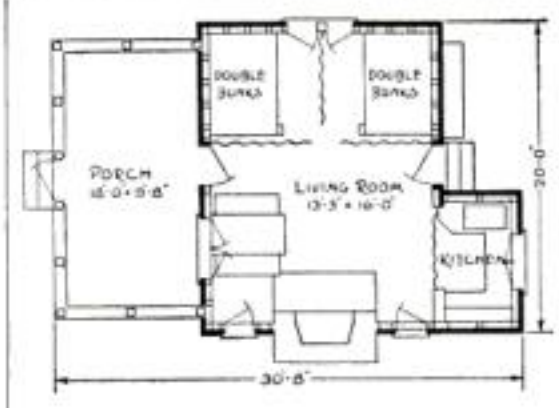

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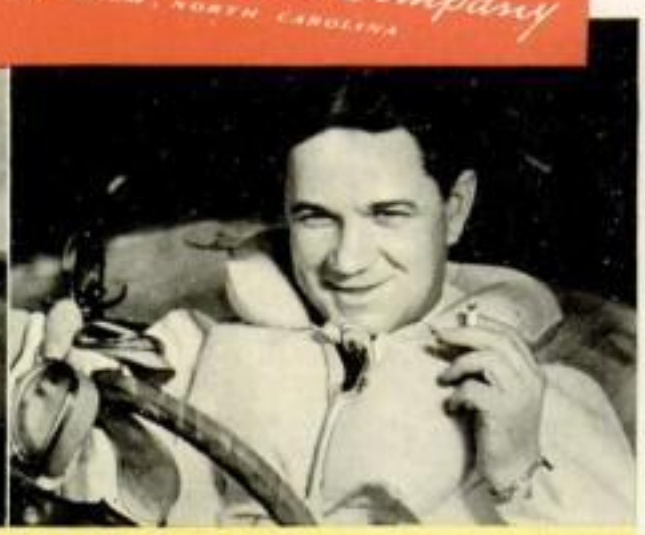

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